PRICE 50 CENTS

American Machinist

OCTOBER 10, 1955

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

WORLD'S BIGGEST JOB SHOP

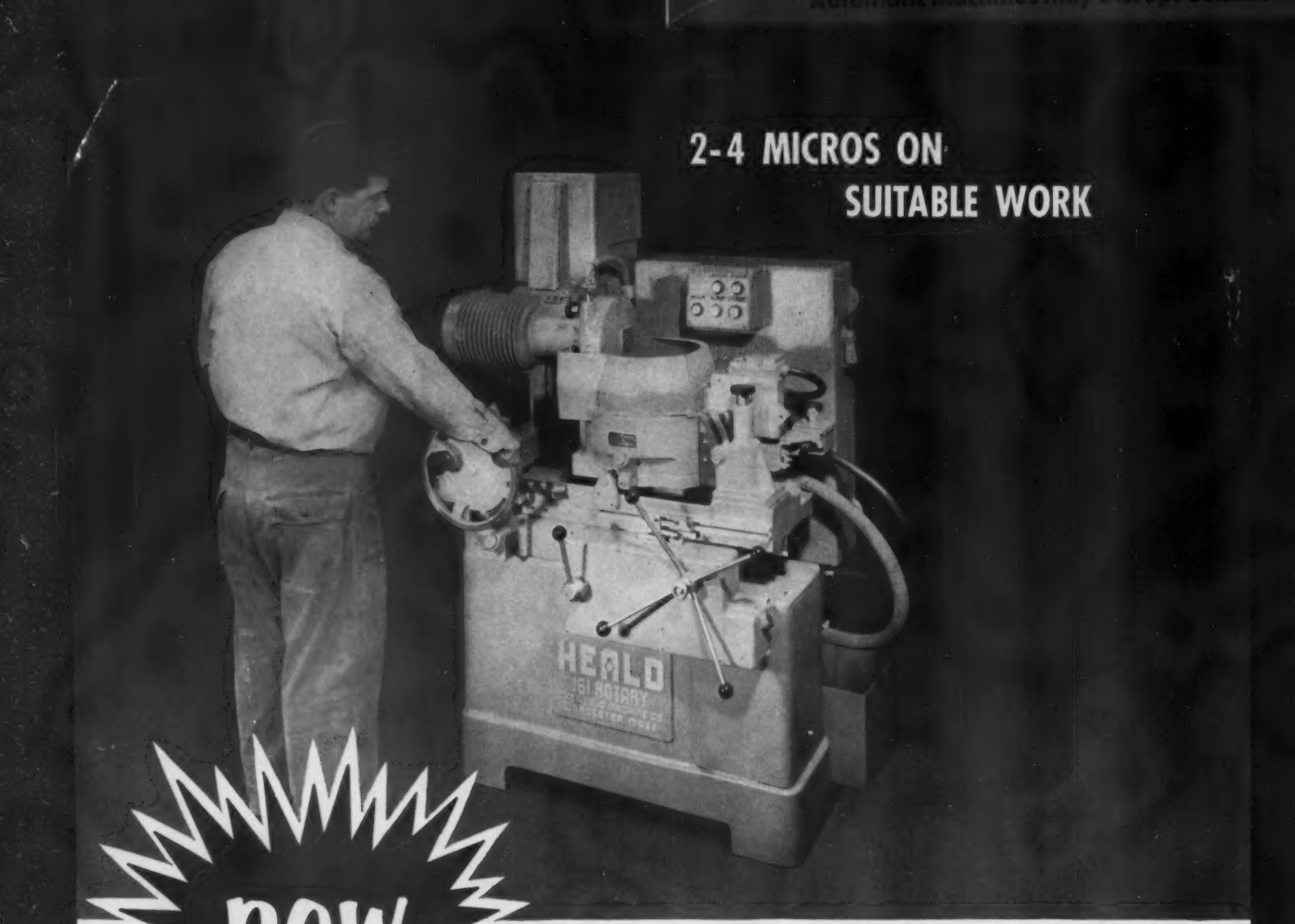
A SPECIAL REPORT

Twin-table planer-miller slashes setup time — see page 2

METAL SHOW ISSUE

How Shell Molding Affects Machining . . . Electrical Discharge Die Sinker

Automatic Machines May Disrupt Communications . . . High-Mod Tool Shanks



new

HEALD MODEL 161 ROTARY

provides new precision and economy for surface grinding **SMALL PARTS**

- **Manual or Power Reciprocation**
- **Dry or Wet grinding**
- **Simple Mechanical Operation**
- **Grinds Flat, Convex or Concave**
- **Extremely Low Microinch Finish**
- **6" Magnetic Chuck**
- **Extra Rigidity and Weight**
- **More Power to Wheelhead**
- **Column-Type Construction**
- **Moderate Cost**

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Choice of manual or automatic power table reciprocation permits maximum operating efficiency on individual parts, small lots or long run jobs. Other outstanding features of this compact, versatile surface grinding machine are listed at the left. The bulletin mentioned below will give you the complete story.

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American Machinist is indexed regularly in the Engineering Index and the Industrial Arts Index

American Machinist, published bi-weekly, with an additional issue in mid-November, by McGraw-Hill Publishing Company, Inc. James H McGraw (1860-1948), Founder. EXECUTIVE, EDITORIAL, ADVERTISING AND PUBLISHING OFFICES: McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Donald C McGraw, President; Paul Montgomery, Executive Vice President; Joseph A Gerardi, Vice President and Treasurer; John J Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B Smith, Vice President and Editorial Director; Joseph H Allen, Vice President, Director of Advertising; J E Blackburn Jr, Vice President and Circulation Director.

SUBSCRIPTIONS: Address correspondence to American Machinist-Subscription Service, 330 West 42nd Street, New York 36, N Y. Allow one month for change of address. Subscriptions are solicited only from production executives and engineers in the metalworking industries. Position and company connection must be indicated on subscription orders.

Single copies, 50c. Subscription Rates — United States and possessions, $5 a year, $8 for two years, $10 for three years. Canada $7 for one year, $11 for two years, $14 for three years. Other Western Hemisphere and the Philippines, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. Second-class mail privileges authorized at New York, N. Y.

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NUMBER OF COPIES PRINTED IN THIS ISSUE 38,681

chips

SPLIT TABLE . . . We've talked about dual-table machines to save setup time, but have never shown one on our cover. So here is an 84-in. Ingersoll planer-type miller in GE's Large Steam Turbine-Generator Dept (see next item). Obviously, one table can be set up while the other is under the cutters—which brings a larger production return on the investment. If necessary for a big job, the tables can be ganged together. GE has added special handling and cutter grinding for multishift operation—you'll find details in our Special Report.

JOB SHOP . . . For several years, we have made periodic pilgrimages to the GE steam-turbine plant in Schenectady. It's unbelievably big, and takes several pilgimages to cover. Late this spring, we were at last given permission to explore this plant for ideas. The 24-page Special Report in this issue is the result. Four editors contributed to it: Tangerman and Linsley collected the shop operations, while Stocker wrote the management study and Ashburn the maintenance story. All have been checked and rechecked, so should be as authoritative as can be. Your close study will be repaid by ideas that you can use, regardless of your plant's product . . . We felt that there was so much here on the basic problem of suitable metals that it should be the feature of our Metal Show Issue.

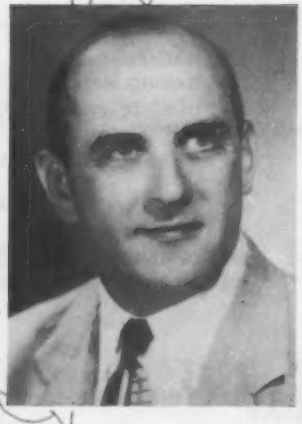
RFI . . . Here is a problem that is growing—radio interference from automatic machines. We give a preliminary story. Must all builders hire radio engineers so a pilot's SOS will not be jammed?

WHAT'S COMING . . . How does shell molding affect machining? Otto W Winter, mgr Shell Molding Div, Beardsley & Piper, gives a step-by-step discussion, showing operations simplified or eliminated by this broadly applied process . . . Also, George L Weiser, asst chief tool engineer of Delco-Remy Div, GMC, shows how to cut die and mold costs, save on diamond wheels ,and how to modify existing tools for design changes— all with the aid of an electrical-discharge head on a diesinker.

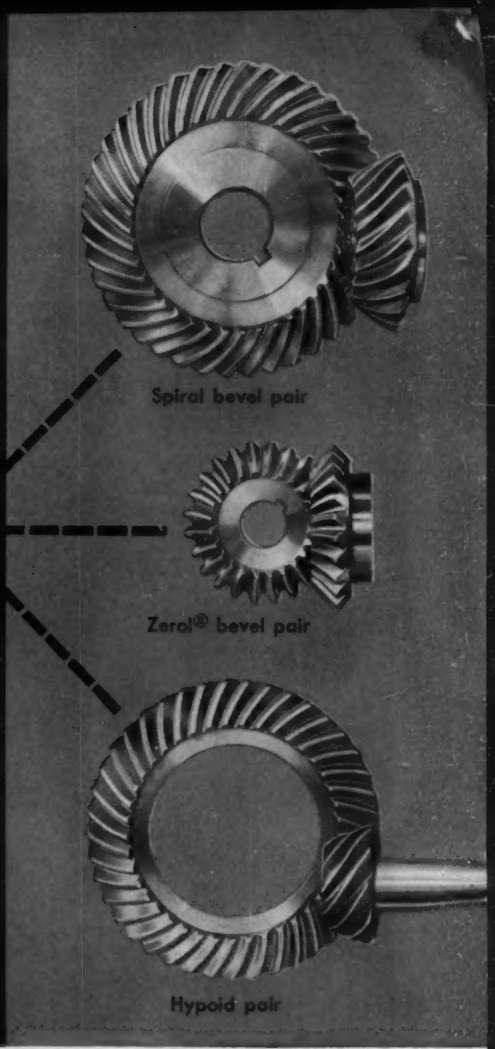
NO CHATTER . . . Tool chatter usually results from lack of rigidity in the tool shank. W L Kennicott of Kennametal, Inc, presents practical proof that shanks of solid carbide have sufficient rigidity to solve the problem . . . For additional tooling data, we present a half-dozen shop pictures from Dumore.

WELDS FOR TEMPERATURE . . . Chrome-moly steel is a tough material to weld, particularly because it often must withstand high temperature accompanied by high pressure. A new electrode and a special technique solve the problem. L C Nesbitt of Metal & Thermit Corp tells the story.

COMING . . . *AM* for Oct 24 will include a Special Report on how to work the superalloys, plus articles on replacement policy, plant-keeping, mechanized brazing, probability, rebuilding machines, and vibration cleaning. There's a lot in this one worth picking ideas from.



Shell Molder . . . Otto W Winter is a Tau Bete and BIE from Ohio State. He has been with Cincinnati Milling Machine, Whitman & Barnes, Kent Owens, Columbus-McKinnon, Republic Drill & Tool, and Acme Pattern & Machine Co, at the latter as president and general manager. Since 1950 he has been president and general manager of Winter Engineering Co and began development of shell-molding equipment and tooling in 1951; is also currently in a consulting capacity for Beardsley & Piper. He is a member of ASME, ASM, AWS, AOA, and Amer Foundrymen. He has the unique distinction of being first chairman of two chapters of the ASTE, Detroit and Toledo, was also chairman in Buffalo. Has held many ASTE offices, culminating in the presidency in 1942-43. His discussion of the affect of machining on shell molding is in this issue.



One cutter produced these three gear pairs!

The new Gleason No. 116 Hypoid Generator used *one* Unitool* Cutter to generate the three gear pairs shown above. Only five additional Unitool Cutters are needed on this generator to cut spiral and Zerol® bevel gears of any ratio, and hypoid gears of 3:1 ratio and higher; up to 14″ pitch diameter.

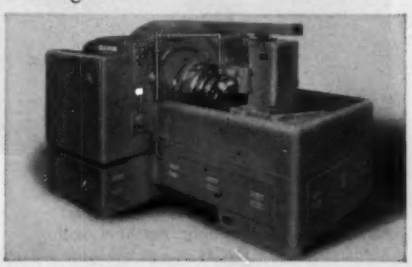
The Unitool Method was developed especially for use with the No. 116 Hypoid Generator, and its smaller counterpart, the No. 106 Hypoid Generator. This new method requires only a small tooling cost to cover the entire range of both machines.

It is intended for the production of small quantities of bevel and hypoid gears, and does not replace the cutting methods now in use for mass production. When using these methods, the No. 116 Generator is substantially faster than previous models.

In addition, the new features incorporated on the No. 116 offer simplification of tooth bearing development, improved quality, and much easier setup and operation.

We shall be glad to send more information on the No. 116 Hypoid Generator and the Unitool Method for producing small quantities of bevel gears.

** Trademark*



The No. 116 Hypoid Generator cuts spiral bevel, Zerol bevel and hypoid gears up to 18″ pitch diameter, any ratio up to 10:1, any pitch 2 DP and finer.

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Builders of bevel gear machinery for over 90 years

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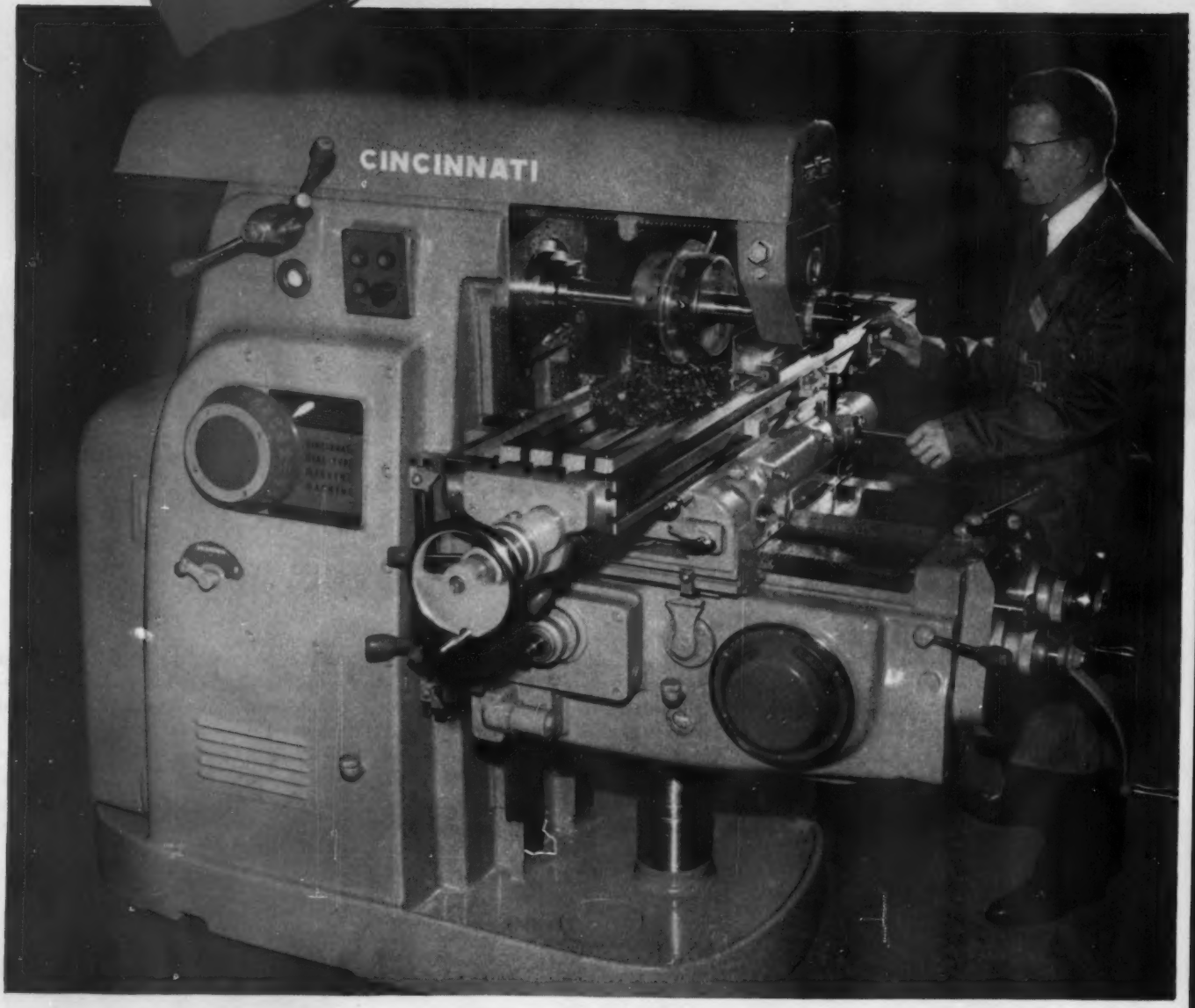
THE NEW



Automatic milling, using a simple one-way feed cycle on a New CINCINNATI Plain Dial Type Milling Machine with Automatic Table Cycles

CINCINNATI

CINCINNATI DIAL TYPE MILLING MACHINES

Will be a Big Hit in Your Shop

Ask anyone who was there. The four new CINCINNATI Dial Type Milling Machines were a big attraction at the recent Machine Tool Show. And the new Dial Types are bound to make a bigger hit in your shop . . . with the operator and foreman . . . with the methods engineer . . . with the new equipment analyst.

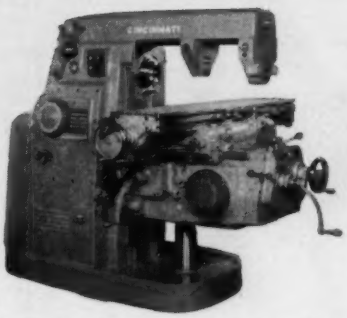
The new Dial Types are easier and safer than ever before to operate because of their dual push-button controls; complete safety from spinning hand cranks; large and conveniently located speed and feed dials.

The new Dial Types have the capacity to take on more work than ever before . . . higher ranges of speeds and feeds (up to 90" per minute feed rate); more than 50% increase in power; fully automatic table feed cycles if you want it; automatic backlash eliminator standard equipment.

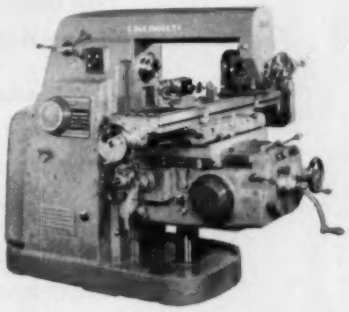
The new Dial Types will satisfy the most critical equipment analyst . . . built-in, completely protected electrical controls; feed drive motor, unit construction and cradle type mounting of main drive motor reduce maintenance expense; operators can utilize their energy more productively; big variety of work, including high production jobs, can be assigned to *the New Dial Types.*

Everywhere you look you'll find new Dial Type features of value in your shop. There are many, many more than outlined here. You will get a better idea from the new catalog. Write for your copy of publication No. M-1915.

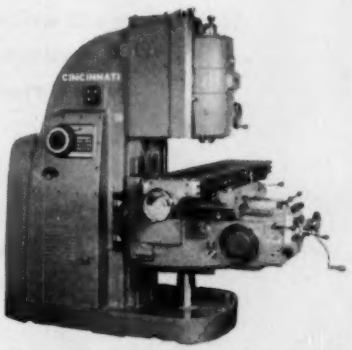
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



The New CINCINNATI No. 2 Plain Dial Type Milling Machine



The New CINCINNATI No. 2 Universal Dial Type Milling Machine



The New CINCINNATI No. 3 Vertical Dial Type Milling Machine

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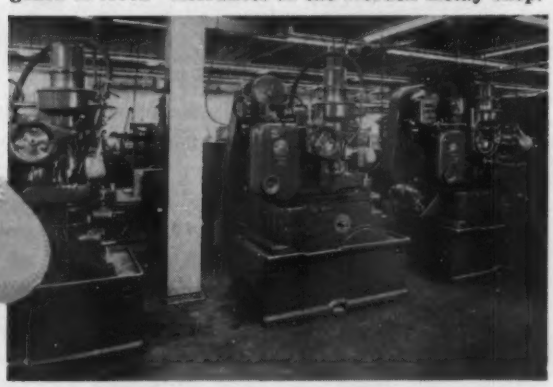
CINCINNATI

Where .0002" is FELLOWS

Battery of Fellows 3" Gear Shapers (above) and 7-Type Gear Shapers (below) are daily turning out gears to .0002" tolerances in the Norden-Ketay shop.



THE PRECISION LINE

tolerances are routine...

is *standard* equipment!

Bomb director systems! Computers! Fire Control systems! Aircraft engine and flight control instruments! These are some of the products designed and manufactured by the Instrument and Systems Division, Norden-Ketay Corporation!

At the heart of these electro-mechanical devices are gears and gear trains which must have runout tolerances within .0002". To produce these high-precision gears Norden-Ketay relies upon Fellows Gear Production Equipment.

Fellows fully integrated line of machine tools assures absolute control over quality, as well as costs, wherever fine-pitch gears must be made to rigid specifications. In addition, they incorporate many modern features that not only permit much faster feeds and speeds, but also hold set-up time and change-over periods to a minimum.

If you are manufacturing fine-pitch gears, it will pay you to follow the example of other leaders in the industry, and consult with your Fellows representative. He will gladly provide all the technical data you desire, and where requested, give complete information about the Fellows Plan for deferred payment.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 319 Fisher Building, Detroit 2 • 5835 West North Avenue, Chicago 39
2206 Empire State Building, New York 1 • 6214 West Manchester Avenue, Los Angeles 45

Fellows *Gear Production Equipment*

EXTRA!
EXTRA!

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Features

QUILL Adjustable CUTTERHEAD

Gives Work-Ability of Two Single Purpose Milling Machines...

PLUS...

Accurate Boring and Drilling with the Same Machine without Attachments

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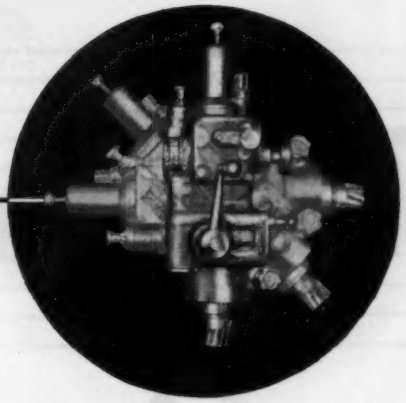
VAN NORMAN

MANUFACTURERS of—Ram Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.



Quill Adjustable Cutterhead makes the No. 16S the most Versatile Miller Available

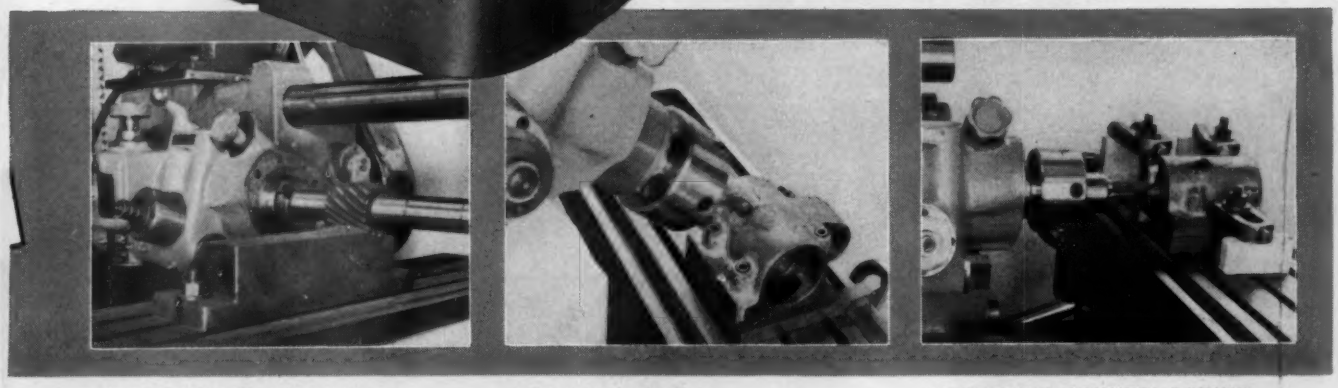
Permits Horizontal, Angular and Vertical Milling, Boring and Drilling on ONE MACHINE.

Phone, wire or write for more information and catalog giving complete details.

No. 16S...

4″ Quill Travel; 3 Quill Feeds; .0015, .003, .006; 8 Spindle Speeds; 110 to 3600 RPM; Table Size 40½″ x 10″; Cutterhead Spindle Motor 2 HP

HERE'S HOW IT WORKS...



A HORIZONTAL MILLING

A horizontal milling cut performed on a cast iron base. Width of cut 2¼″; Depth .25″; 3″ wide helical slab milling cutter; Speed 110 RPM; Feed 6 IPM.

ANGULAR BORING

Angular boring on a cast iron saddle bracket boring a 1″ dia. hole. Depth of bore 1¾″ removing ⅛″ stock on roughing cut. Finish cut removes .010″; Tolerance on I.D. .001″.

HORIZONTAL COUNTER BORING

Horizontal counter boring operation of a 3″ dia. hole on same saddle bracket. Depth of cut 1″ to a shoulder removing approximately ⅛″ on rough cut. Finish cut .010″; tolerance on I.D. .001″.

COMPANY

SPRINGFIELD 7, MASSACHUSETTS

THE NO. 32C

for Cutting Large

• HARDENED and 60%

LANDIS *Machine* CO.

WORLD'S LARGEST MANUFACTURERS OF THREAD

LANDMACO

Diameter Threads—

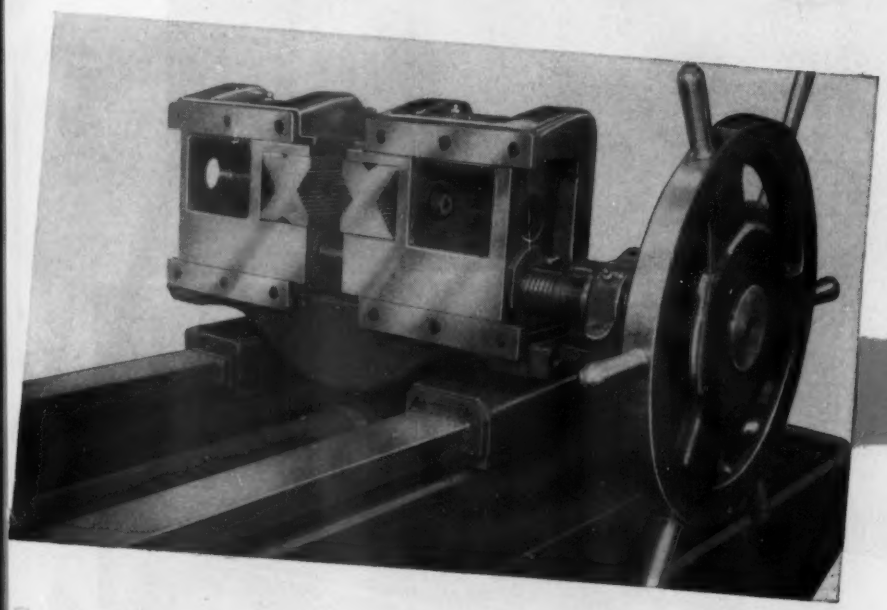
GROUND WAYS • WIDE SPEED RANGE
MORE GRIPPING POWER • 6" CAPACITY

A new LANDMACO Threading Machine with many improvements and new design features has been developed for heavy-duty precision threading on large diameter work. The first installation of this new LANDMACO is shown threading "Unbrako" Screw Products of TS4140 steel at the Standard Pressed Steel Company, Jenkintown, Pa. 1½" diameter 12 pitch UN threads are being cut 2 29/32" long to a Class 3 fit.

The carriage front, based on a new principle, assures proper work alignment under gripping pressure and gives 60% more gripping efficiency. Heavy hardened and ground rectangular ways firmly guide and support the carriage.

A single gear shift lever is provided for a rapid speed change of 25% for any given spindle speed as determined by the speed change gears in use. Three pairs of speed change gears provide twelve spindle speeds ranging from 9 to 152 revolutions per minute.

This machine is equipped with either the 4" Standard Rotary Head or the new 6" (6-chaser) Lanco Head. It will cut bolt threads from 1½" to 6⅝" in diameter, and pipe threads from 1" to 6" in diameter. Maximum thread length is 29" with leadscrew and 30" without leadscrew.



This machine is also available in a Double-Spindle model with a 7½" carriage travel for pipe and nipple threading. For more information on the 32C and 48C Landmaco Threading Machines, write for Bulletin H-45.

LANDIS REG. U.S. TRADE—MARK

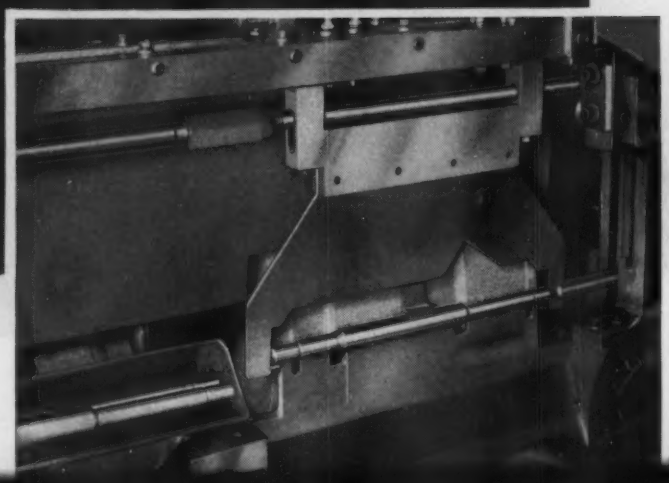
WAYNESBORO
PENNSYLVANIA

GENERATING EQUIPMENT

Cuts Both Grinding and Inspection

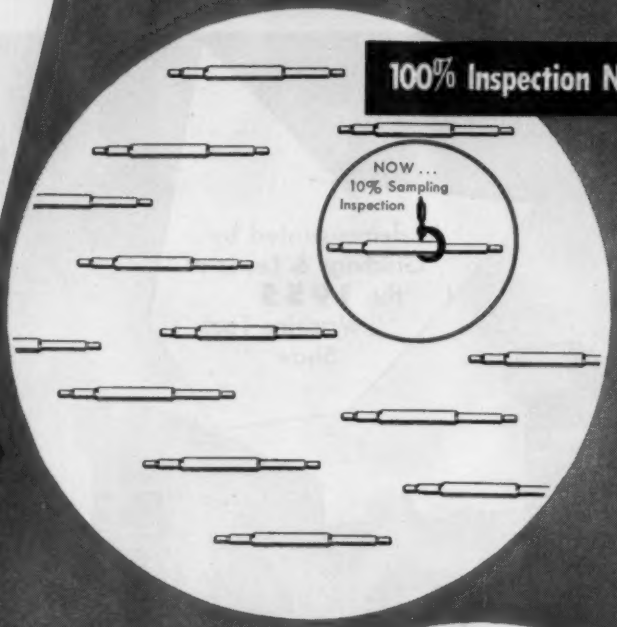
Improves work uniformity from .0007" to .0003"

Since using two Landis No. 12½ Centerless Grinders, a major automotive parts manufacturer is now grinding shafts with these results. The superior accuracy of these grinders at high production rates is due to their unmatched rigidity.



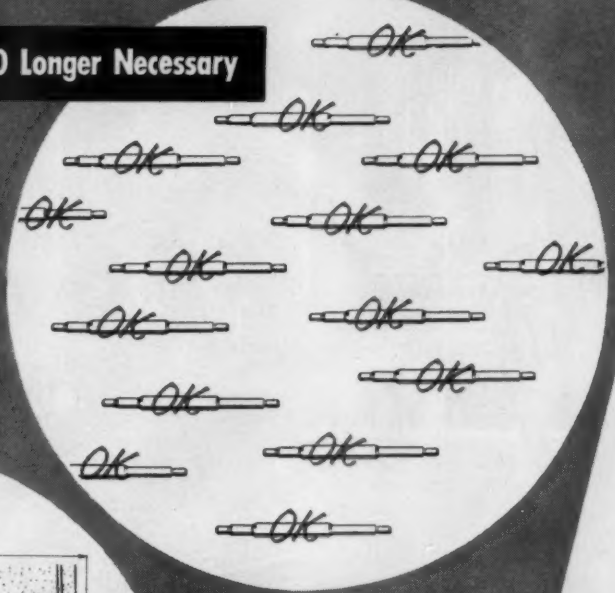
#12½ Centerless Grinder with automatic loading and unloading.

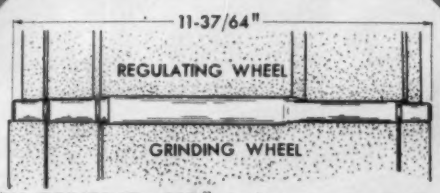
Costs



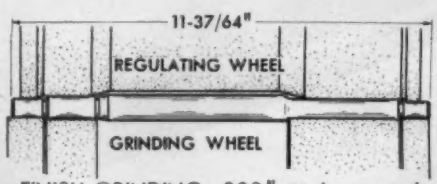
100% Inspection NO Longer Necessary

10% Re-runs NO Longer Necessary





ROUGH GRINDING: .010" stock removal—5 diameters



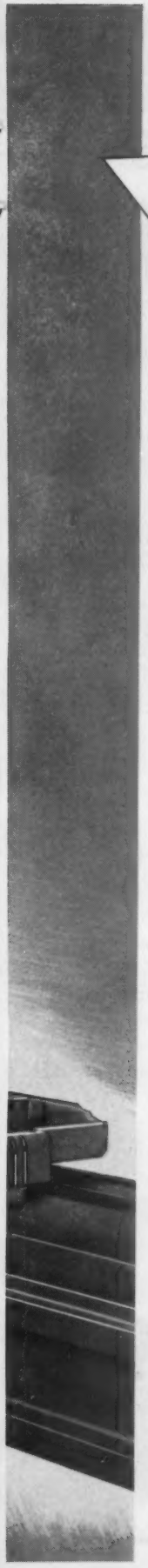
FINISH GRINDING: .003" stock removal
—4 diameters

Grinds 380 Shafts per Hour

LANDIS TOOL COMPANY
WAYNESBORO, PENNA.

LANDIS
precision grinders

REVOLUTIONARY G&L DESIGN!
New Planer-Miller features include 10-inch quill, four heads each with 50-hp water-cooled motor, all-electronic controls and table drive. Other new developments are feed reel, hydraulic counterbalance and coolant systems.



NEW

Cool-headed Goliath...
master of low-cost production

Here's Giddings & Lewis all-new Hypro Planer-Miller... superbly engineered for high-speed, super-precision milling...years ahead in modern machine design

GIDDINGS & LEWIS offers you the world's finest 10-inch quill Hypro Planer-Miller—a 120-ton 72" x 72" x 24' giant of low-cost production. It's available with a wide variety of table and bed lengths and up to 144" width. Every principal machine component is designed to give you the ultimate in precision plane milling at high speeds. Revolutionary design features include:

MILLING HEADS—Each of four heads, powered by a 50-hp, 1800-rpm water-cooled motor, is provided with 24 spindle speeds in fine geometric progression from 9 to 500 rpm. Each head is equipped for "toe-in-or-toe-out" positioning for milling different types of steel alloys . . . or to accomplish special roughing or finishing operations. This feature also offers particular advantages for boring operations.

TABLE DRIVE—Because table drive is designed for practically zero backlash, it permits both climb and conventional milling with equal facility. New heavy-duty jaw clamp securely holds the table in position for cross-milling.

CONTROLS—All auxiliary functions of machine are electronically-controlled from permanent-type panel, and all operating functions from a traveling pendant station. Floor-mounted control station is for set-up purposes. Also, there are calibrating indicating instruments for direct reading of feeds in inches-per-minute and spindle hp consumption. Control is also provided for starting and stopping all service functions complete with indicating lights to show that these services are operating properly. Controls are properly interlocked so that duplicated control functions operate at only one station at a time.

FEED REEL SYSTEM—Giddings & Lewis' new feed reel system encloses all electrical, hydraulic and coolant facilities—usually found as collection of cables and wires around headstocks on conventional machines.

HYDRAULIC COUNTERBALANCE SYSTEM—An exclusive design by G&L, this new development plays an important part in flatness accuracy in milling with rail heads. It reduces to a minimum the wear between rail and headstock saddle. It also reduces appreciably the amount of power necessary to feed the heads and rail.

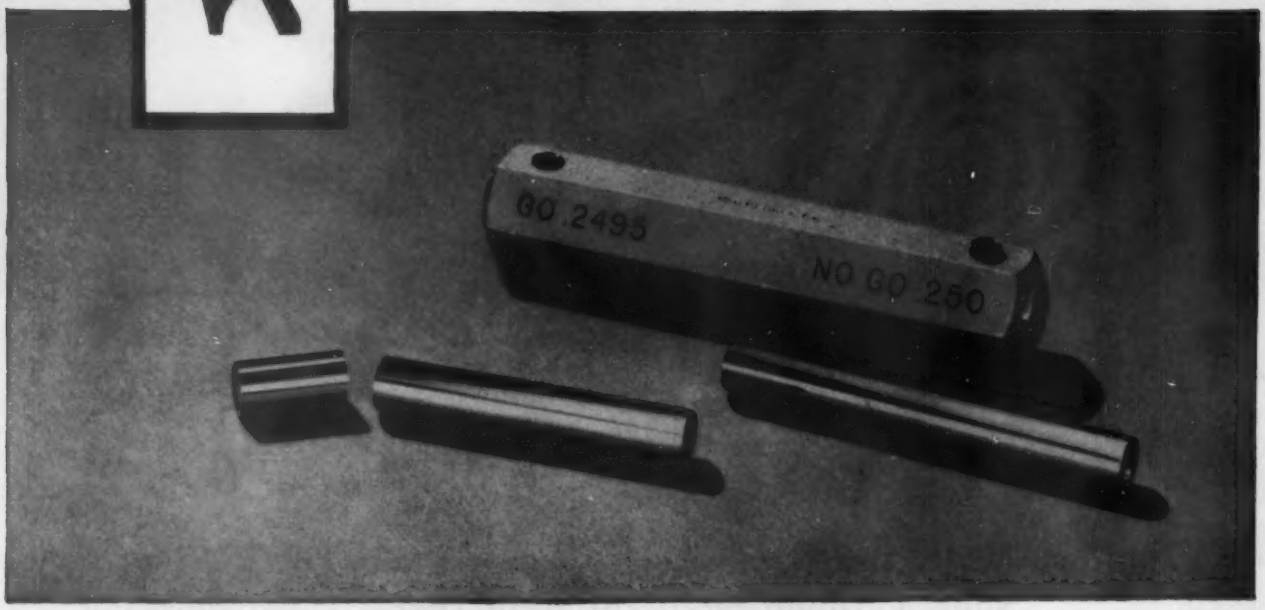
For complete specifications on the Giddings & Lewis new Hypro Planer-Millers, contact your nearest representative, or write—

GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty machine tools—Horizontal Boring, Drilling and Milling Machines—table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines; Vertical Boring Mills; Upright and Radial Drilling Machines; and Davis Boring and Cutting Tools.

VK WIRE TYPE PLUG GAGES



VASTLY LONGER-LIVED *and* MONEY SAVERS...

because they're "Cut-Off-Able" as well as "Reversible"

As a Van Keuren agent put it, "They're not only reversible, they're cut-off-able." And that means when you buy Van Keuren Wire Type Plug Gages, the sizes below ⅜" may be cut off when ends become worn and as many as from five to ten gages made available from the 1⅞" and 2" long units. It is not only economical and practical to use Van Keuren Gages but it is a very simple operation to cut off the ends by following instructions furnished on request. The illustration above shows clearly the cut-off and reversible features.

VK Wire Type Gages are available in ZZ to XXX accuracies in sizes from .001" to 1.000". They are furnished in alloy tool steel, high speed steel, chromium plate or tungsten carbide. Whatever the gaging job, the extra length provided in VK units will save you money. It will also pay you to take advantage of VK deliveries. In many cases we can ship your requirements from stock.

VK Wire Type Plug Gages are fully described in Catalog & Hand Book No. 36, available on request.

Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

VK

36th YEAR

THE Van Keuren CO.,

173 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Laps and Surface Plates . . . Precision Lapping Service.

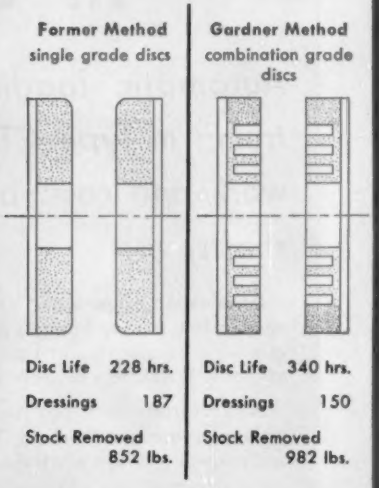
Disc life increased by 50%

Combination grade Gardner discs cut down time remove more metal per disc

Softer grade with deep corrugations for rapid chip clearance

Harder Grade Smooth section for shear cut and uniform wear

Double disc grinding of small coil springs caused "bell-mouthing" of discs, low production, excessive dressing . . . . Gardner Abrasive Specialist recommended combination grade disc with smooth outer face of harder grade and deep corrugated inner surface of softer grade. The harder outside section resists wear, results in greater stock removal, longer life, fewer dressings.



GARDNER

abrasive discs

BELOIT, WISCONSIN

NOW!... Norton Offers Further Automation

in Cylindrical Grinding

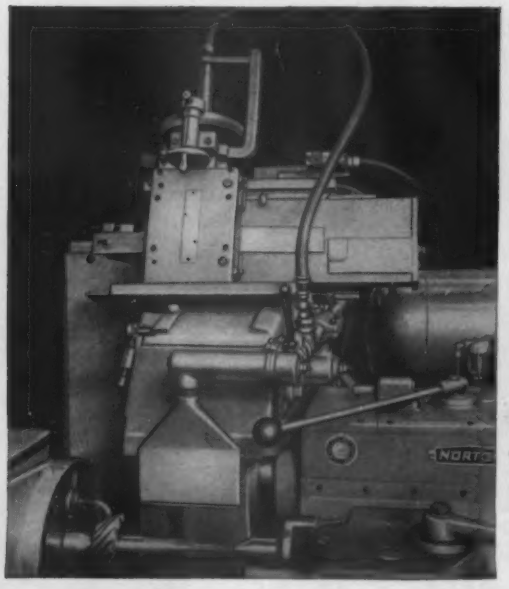
Automatic loading and wheel truing in Type CTU cut the time, work and costs of grinding small shafts.

Automation made one of its most spectacular advancements when Norton brought out the automated crankpin grinder — the sensational machine that adjusts, grinds, gauges and transfers entirely automatically.

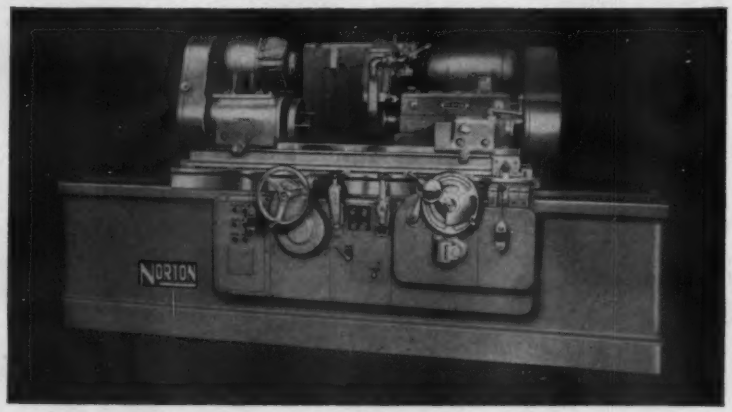
Now Norton is happy to announce further news-making progress in this field. To cut the production time and costs of grinding small shafts, new Norton Type CTU Semiautomatic Cylindrical Grinders may now be equipped with automatic loading. Combining this new feature with automatic wheel guard type truing makes this machine fully automatic in operation.

Thus the fastest, most economical and versatile grinding machine of its type is stepped up to new heights of efficiency.

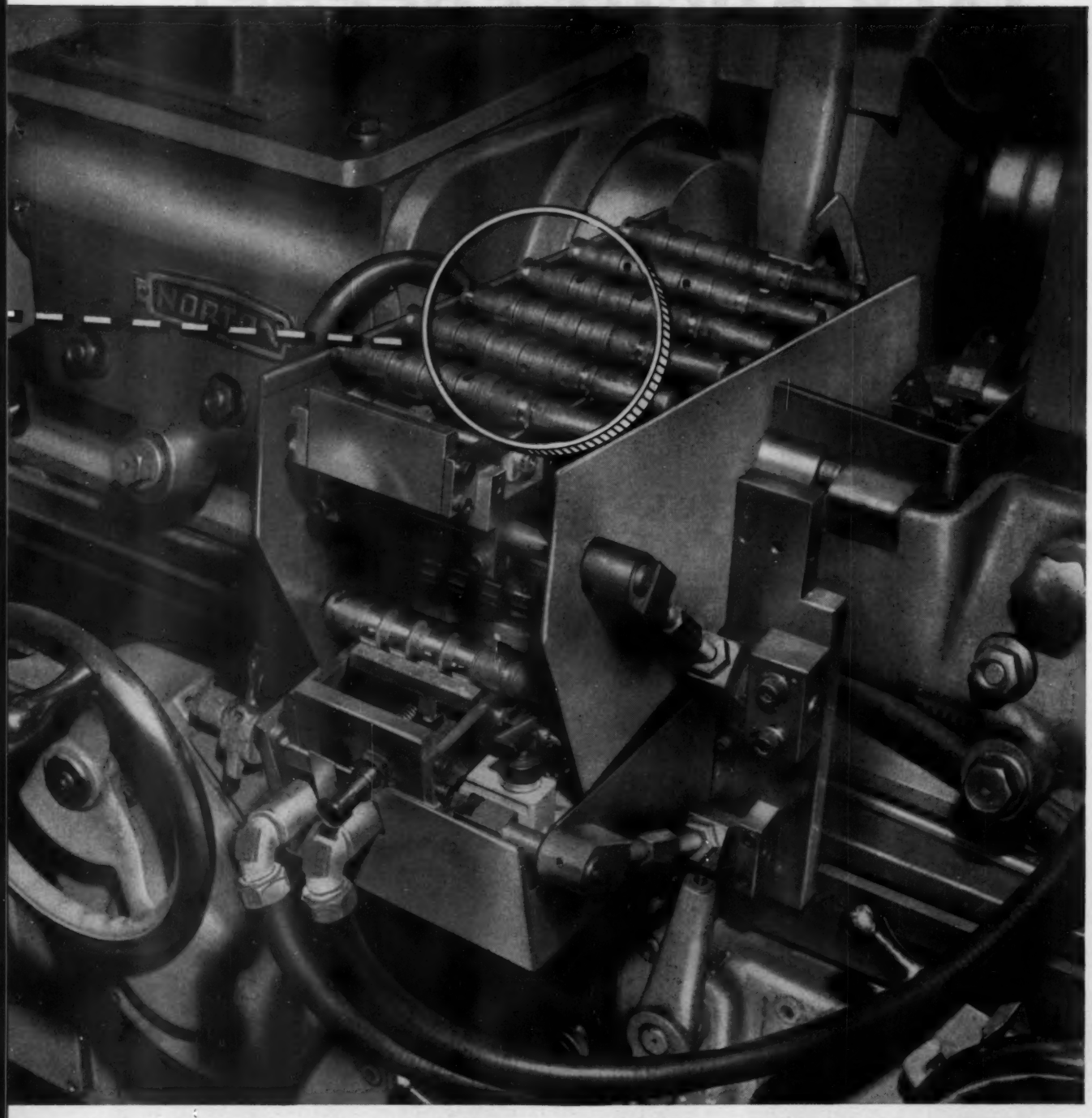
Why not see your Norton Representatives for complete facts on how these and many other advanced features of the Type CTU grinder can benefit your own production? Or write us direct. And remember: only Norton offers you such long experience in both grinding machines and wheels to bring you the "Touch of Gold" — to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.



LESS TIME, WORK AND SKILL ARE NEEDED with the Norton wheel guard truing device, a feature of many types of Norton grinders. Shown here on the 10" Type CTU, it functions completely automatically whenever truing is necessary. In so doing it increases production, wheel life and diamond life.



This 10" Type CTU Semiautomatic Cylindrical Grinding Machine, and the 6" size, are now available for automation with Norton-engineered automatic loading and wheel truing advancements.



ANOTHER NORTON MILESTONE IN AUTOMATION. This automatic loading device, latest Norton development for 6" and 10" Type CTU Semiautomatic Cylindrical Grinders, speeds the production and cuts the unit costs of grinding small shafts. Its steadily paced, automatic operation enables a single operator to tend a battery of machines.

The device is adaptable to a variety of these parts, which are rolled by gravity on inclined rails. Latches between the rails separate the shafts and are arranged to release only a single workpiece at a time to the turret, which is carried on a hydraulically controlled swinging arm.

When the workpiece rolls into the turret the arm swings the turret to locate the piece in line with the work centers. As these move forward they raise the workpiece just enough to clear the turret's supporting fingers and permit free rotation.

After grinding — electrically timed — the turret is swung upward. A latch indexes the turret so that the work rolls onto the unloading rails. The turret continues its upward motion to the loading position and receives the next workpiece.

To Economize, Modernize with **NEW**

NORTON

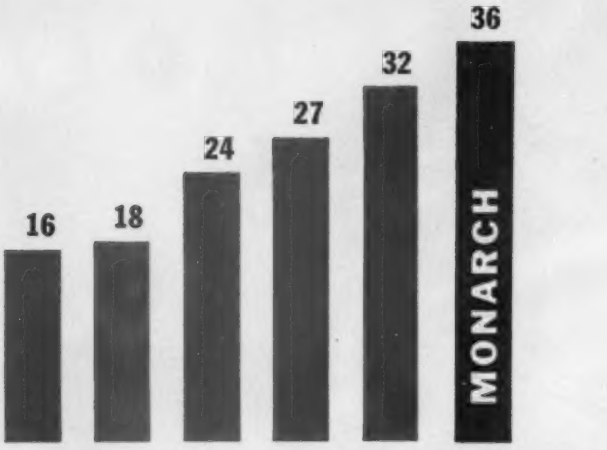
GRINDERS and LAPPERS

Making better products...
to make your products better

District Sales Offices: Worcester • Hartford • New York Area, Teterboro, New Jersey • Cleveland • Chicago • Detroit

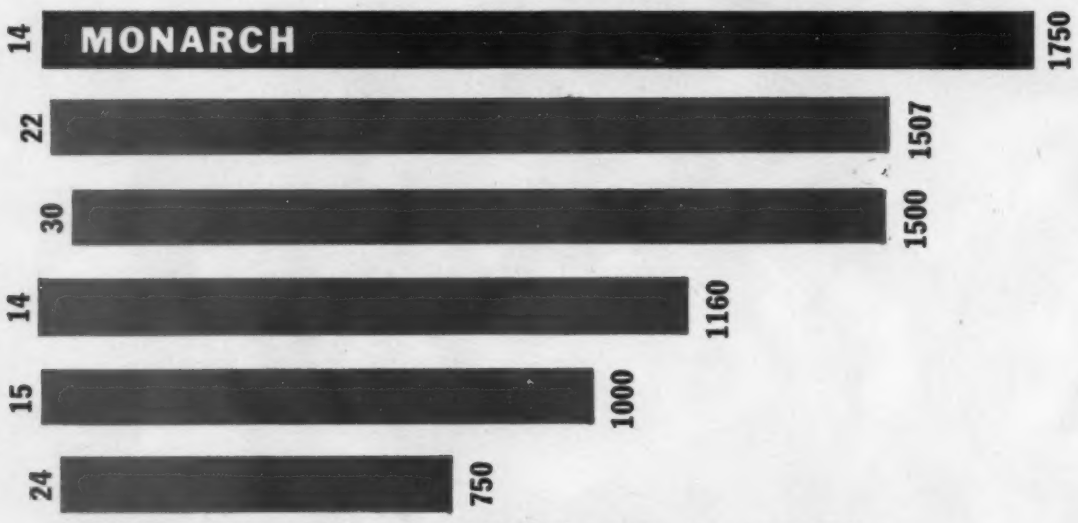
TALK ABOUT SPEEDS!

There's No Matching the Monarch Preselector Dyna-Shift



THE MOST SPEEDS—36

Unique Speed PRESELECTOR DYNA-SHIFT



UNEQUALED RANGE—14 to 1750

Surface Cutting Speed! These three words are the key to top efficiency in the operation of *any* lathe.

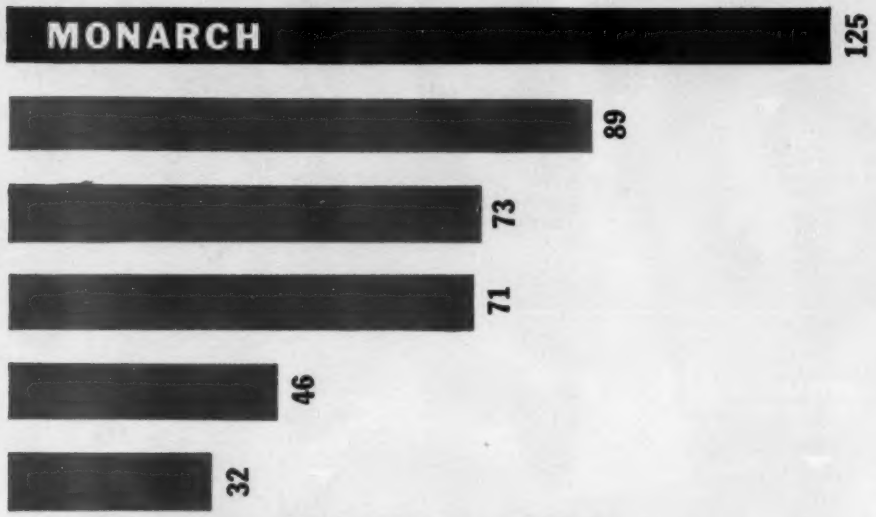
Certainly it's true, you say. But why bring that up? Because only now is a lathe available to give you, practically the correct surface speed, diameter after diameter, piece after piece. That lathe is the new Monarch Series 62 Preselector Dyna-Shift.

It has 36 speeds in a range of 14 to 1750 RPM. Headstock ratio is 125 to 1. And it has *speed preselection.* Here at last is a machine with a standard speed range low enough, high enough and with plenty of speeds in between to make unnecessary a whole assortment of special ranges. With this one standard range you have the power to turn efficiently any part within the work capacity of the lathe.

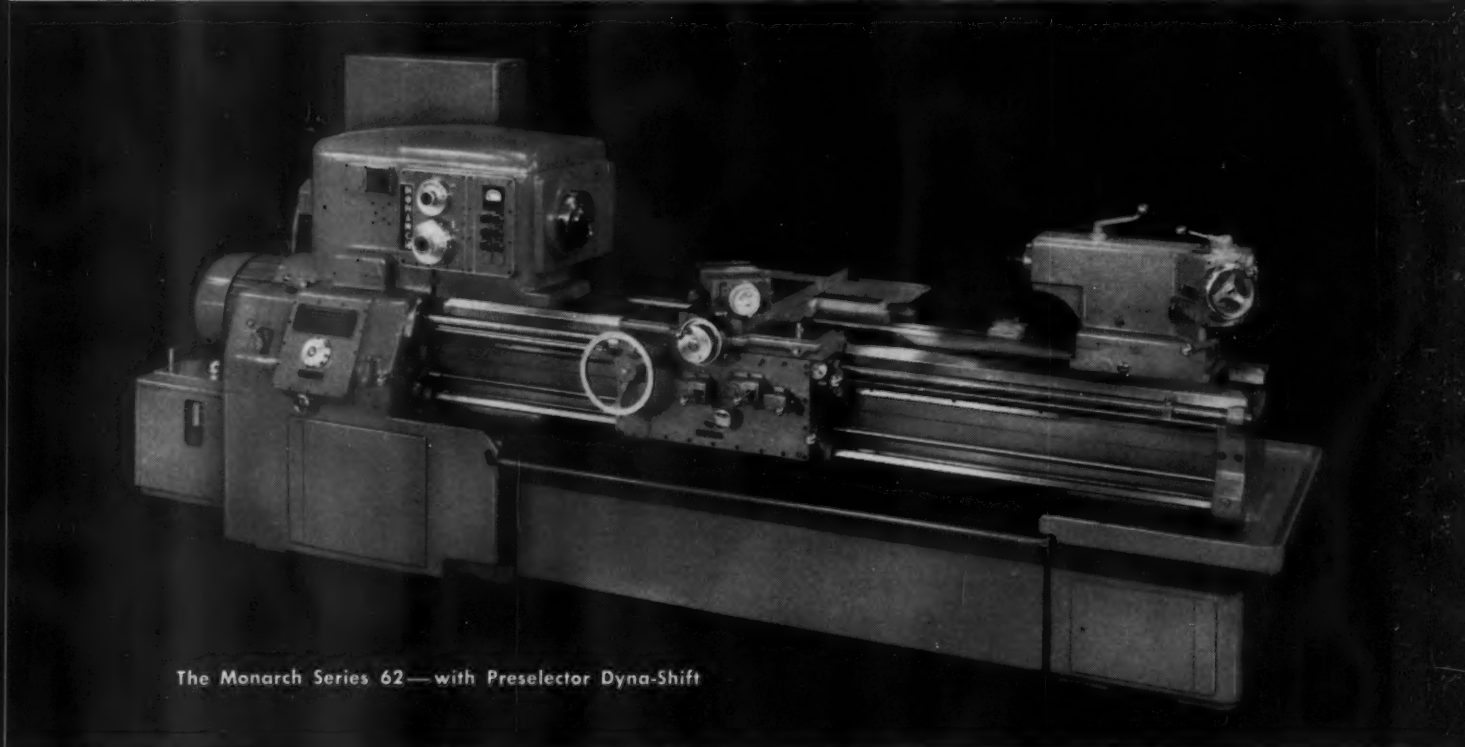
The Dyna-Shift feature makes it unnecessary for the operator ever to figure the R.P.M. he needs for the desired surface speed. He never has to be a calculating machine. He never has to get bleary-eyed figuring a lever setting combination from a complex index plate. He never has to be a color matcher. He never has to set a series of levers in a variety of positions as indicated by the index plate.

All he does is set two large dials on the Preselector Dyna-Shift—one for the work diameter to be turned, the other for the surface speed needed. The machine calculates the necessary R.P.M. and makes the shift automatically. With the preselection feature he may preset up to 6 or more different diameters and set up the shift for each while the machine is turning the previous diameter.

Nowhere but on the Monarch Series 62 Preselector Dyna-Shift can you get this combination. And no other machine can be kept under full load during the entire machining cycle for the utmost in metal removing efficiency. There's an area of cost reduction you cannot afford to overlook any longer. Ask us about it. ***The Monarch Machine Tool Co., Sidney, Ohio.***



GREATEST RATIO—125 to 1



The Monarch Series 62—with Preselector Dyna-Shift

PRODUCTION PLUS

The Monarch Series 62

Increases Productivity up to 25%*
Increases Tool Life up to 50%*

**Figures based on studies comparing step shaft output of Preselector Dyna-Shift with that of a conventional 16-speed headstock lathe.*

Monarch
TURNING MACHINES

THE MONARCH MACHINE TOOL COMPANY, Sidney, Ohio

Gentlemen:

☐ I am interested in your Series 62 story. Please send me your illustrated Booklet #1505 with complete data.

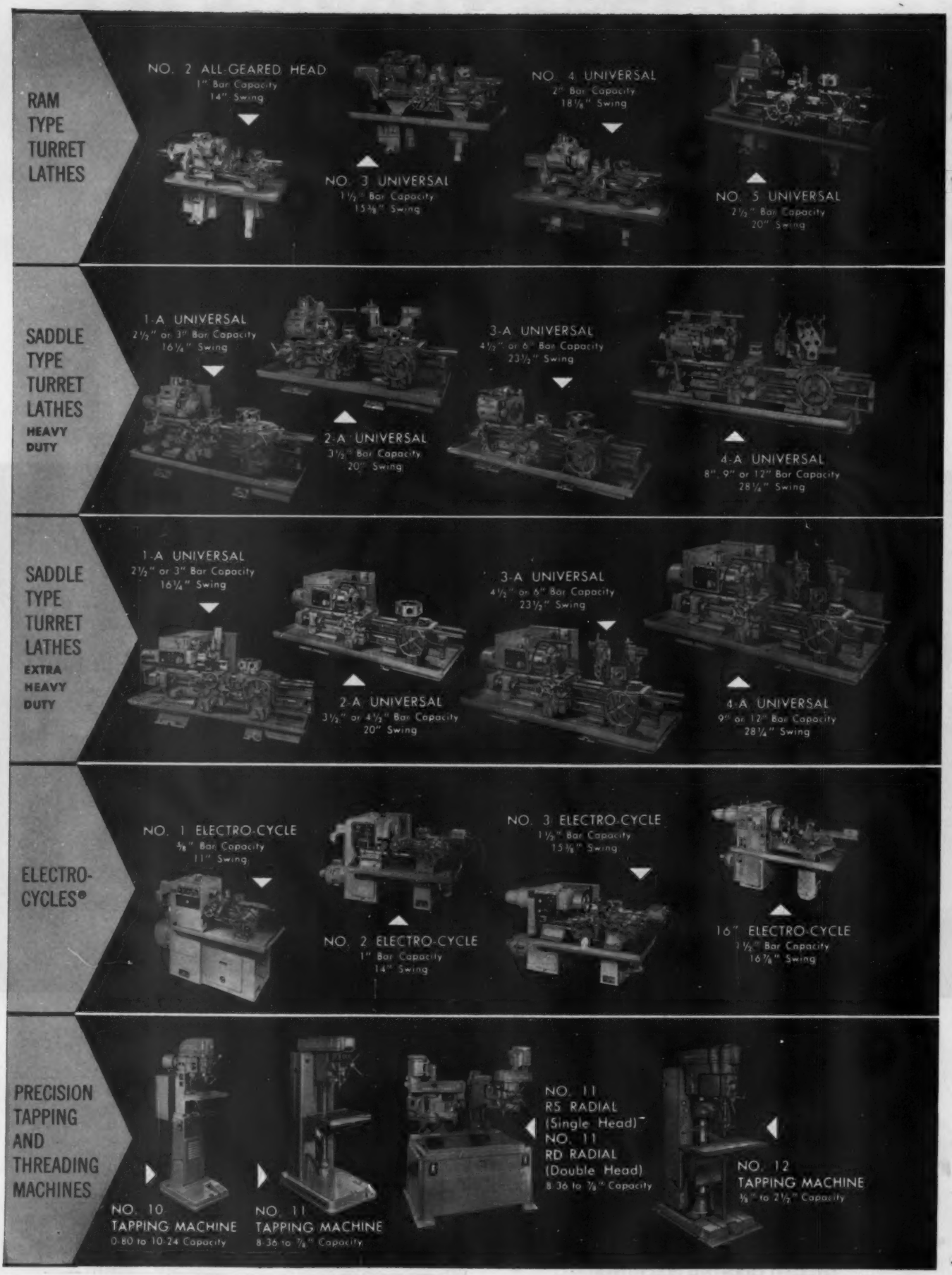
☐ Please have a Monarch sales engineer call on me.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

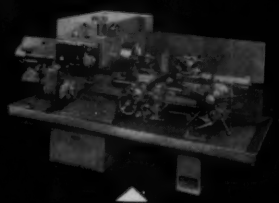
CITY_____ ZONE_____ STATE_____


RAM TYPE TURRET LATHES
NO. 2 ALL-GEARED HEAD
1" Bar Capacity
14" Swing
NO. 3 UNIVERSAL
1½" Bar Capacity
15⅜" Swing
NO. 4 UNIVERSAL
2" Bar Capacity
18⅛" Swing
NO. 5 UNIVERSAL
2½" Bar Capacity
20" Swing
SADDLE TYPE TURRET LATHES
HEAVY DUTY
1-A UNIVERSAL
2½" or 3" Bar Capacity
16¼" Swing
2-A UNIVERSAL
3½" Bar Capacity
20" Swing
3-A UNIVERSAL
4½" or 6" Bar Capacity
23½" Swing
4-A UNIVERSAL
8", 9" or 12" Bar Capacity
28¼" Swing
SADDLE TYPE TURRET LATHES
EXTRA HEAVY DUTY
1-A UNIVERSAL
2½" or 3" Bar Capacity
16¼" Swing
2-A UNIVERSAL
3½" or 4½" Bar Capacity
20" Swing
3-A UNIVERSAL
4½" or 6" Bar Capacity
23½" Swing
4-A UNIVERSAL
9" or 12" Bar Capacity
28¼" Swing
ELECTRO-CYCLES®
NO. 1 ELECTRO-CYCLE
⅝" Bar Capacity
11" Swing
NO. 2 ELECTRO-CYCLE
1" Bar Capacity
14" Swing
NO. 3 ELECTRO-CYCLE
1½" Bar Capacity
15⅜" Swing
16" ELECTRO-CYCLE
1½" Bar Capacity
16⅞" Swing
PRECISION TAPPING AND THREADING MACHINES
NO. 10 TAPPING MACHINE
0-80 to 10-24 Capacity
NO. 11 TAPPING MACHINE
8-36 to ⅞" Capacity
NO. 11 RS RADIAL (Single Head)
NO. 11 RD RADIAL (Double Head)
8-36 to ⅞" Capacity
NO. 12 TAPPING MACHINE
⅛" to 2½" Capacity

No. 4 (M-2240) AND No. 5 (M-2250) RAM TYPE TURRET LATHES

ALL-CLUTCH AUTOMATIC SHIFTING HEAD

NO. 4 (M-2240)
2" Bar Capacity
18⅛" Swing



NO. 5 (M-2250)
2½" Bar Capacity
20" Swing

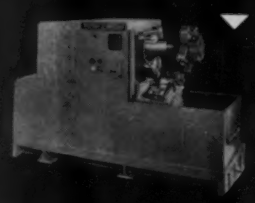
THERE is a proper size and type Warner & Swasey machine to fill your turning needs, for it has always been a cornerstone of Warner & Swasey policy to build an individual model for each type of work.

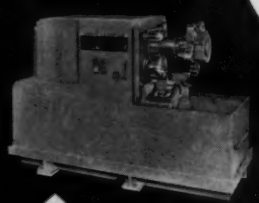
YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY

75TH ANNIVERSARY YEAR
WARNER & SWASEY
Cleveland
PRECISION MACHINERY
1880 — 1955

SINGLE SPINDLE AUTOMATICS

1 AC CHUCKING MACHINE
8" or 10" Chuck —
6" Working Stroke

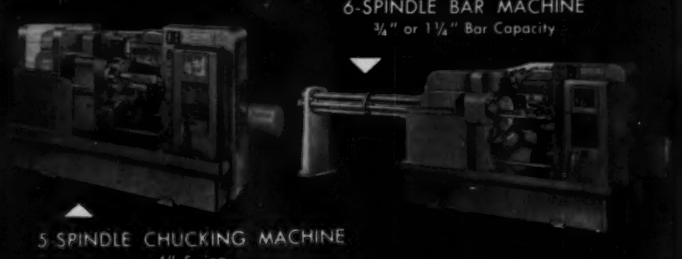




2 AC CHUCKING MACHINE
10" or 12" Chuck —
9" Working Stroke

MULTI-SPINDLE AUTOMATICS

5-SPINDLE BAR MACHINE
1¾" Standard Bar Capacity
2¼" Oversize Capacity



6-SPINDLE BAR MACHINE
¾" or 1¼" Bar Capacity

5 SPINDLE CHUCKING MACHINE
6" Swing

®Reg. U. S. Pat. Off.

MORRIS AIR-OIL-MATIC DRILL UNITS

Fast, low-cost production for drilling and allied operations.

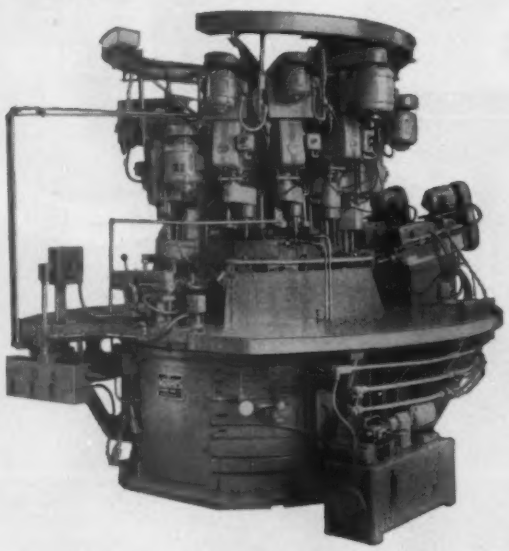
- Adjustable Feed
- Wide range of spindle speeds
- Convenient controls
- Hydraulically controlled

Available for use on Special Purpose Machines like the MORRIS High Production Machines illustrated.

MORRIS CAM-MATIC DRILL UNITS

Newly introduced, MORRIS CAM-MATIC Drill Units provide automatic, electrically controlled, mechanically driven drilling, tapping and allied operations . . with built-in accuracy, dependability and convenience. Specially-featured electric clutch provides automatic thrust control and dull or broken drill detection.

Morris MOR-SPEED



MORRIS HIGH PRODUCTION MACHINES

Special Operations with STANDARD Units

- Specialized Production
- Automatic Indexing and Positioning
- Multiple Operations
- Easy Model Changeover

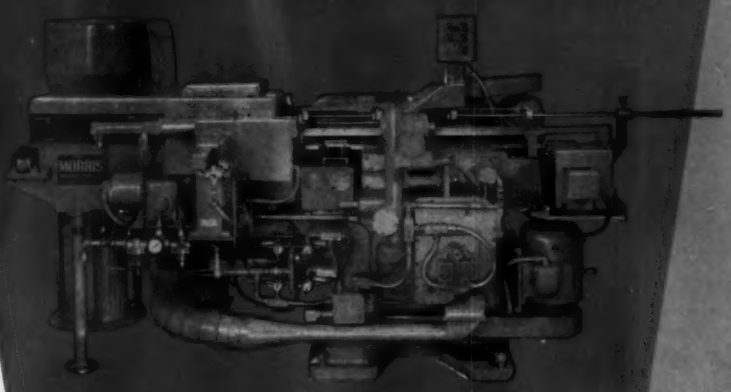
You can have swift, accurate production on multiple operations like drilling, reaming and tapping with MORRIS Mor-Speed High Production Machines. They provide special operations using standard units, with completely automatic operation. Easy re-alignment speeds model changeovers.

MORRIS MOR-SPEED RADIAL DRILLS

4 SIZES - 2 NEW UNITS
Centralized Controls

A complete line of heavy and light production radial drills feature centralized controls for ease of operation, fast production. Two new models utilize hydraulic control for push-button operation and pre-selected feeds and speeds . . . the easiest, fastest operation ever available.

MORRIS AUTOMATIC BALANCING MACHINES



COMPLETELY AUTOMATIC from load to unload, these machines produce up to 720 perfectly balanced pistons every hour. Units are balanced within one gram plus or minus for extreme accuracy required in finished product.

all new

MACHINE TOOLS

Designed for Production PLUS Precision

N E W . . . with proven performance, that's the story of these up-to-the-minute models of MORRIS Machine Tools. For more than 40 years, MORRIS has designed and manufactured high speed, precision equipment. The new models displayed on these two pages are the latest in a series of machine tools that have won the favor of the nation's leading manufacturers.

Your built-in benefit with these new MORRIS Mor-Speed Machine Tools is precise work at high speeds. Make your own comparison of MORRIS features with those of any unit. You'll see why the leaders demand MORRIS!

MORRIS MOR-SPEED MACHINE TOOLS have been selected by the world's leading manufacturers for low-cost mass production of precision-made parts and assemblies. Complete case history data is available FREE upon request.

Write today for catalogs concerning specific machines. If you prefer, outline your production problem. MORRIS engineers will make recommendations for its best solution.

Gallus MOR-SPEED Line

Morris

THE MORRIS MACHINE TOOL COMPANY
933 HARRIET STREET, CINCINNATI 2, OHIO, U. S. A.

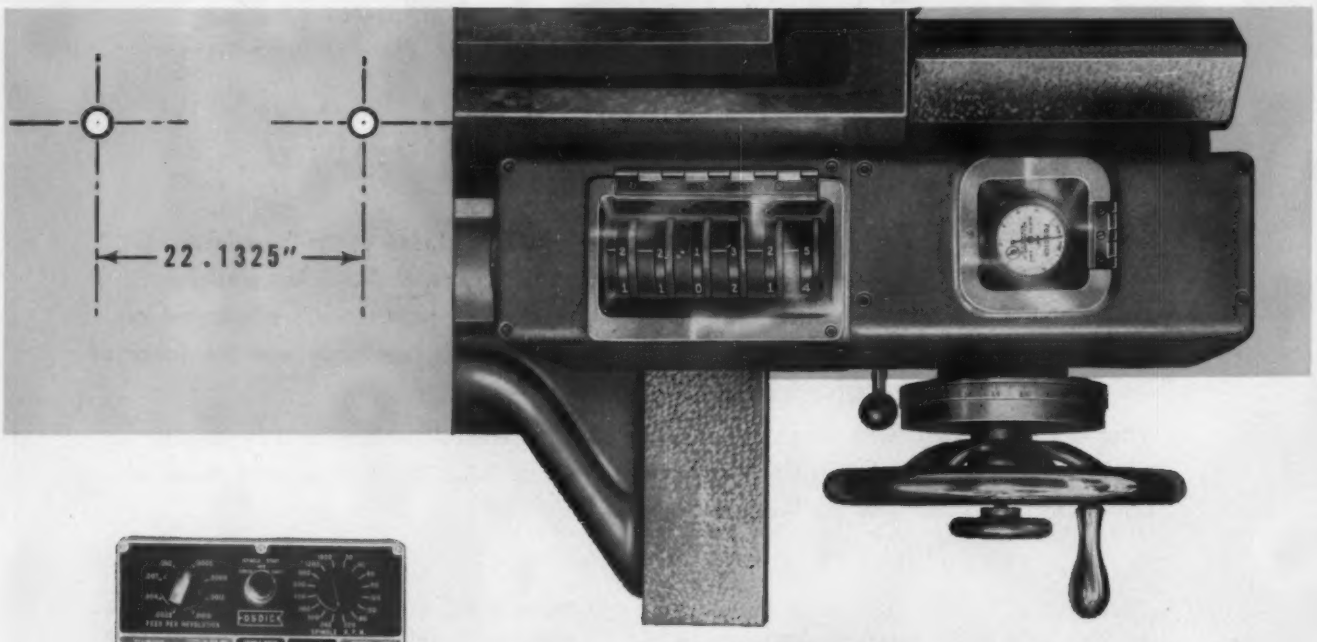
With the NEW Fosdick Jig Borer . . .

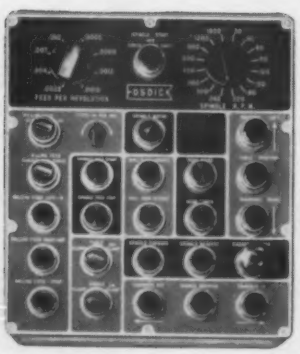
Dial Dimensions Direct from Print

This is DIRECT DIMENSION Measuring!

● This new and exclusive measuring system is the simplest, the most direct ever conceived for a jig borer! It will measure with precision to ± .0001". And the operator need not be highly skilled.

Dimensions from the blueprint are simply set on direct-reading drum dials, one for longitudinal, the other for transverse position. Easily-read numerical dials minimize errors. The finest Class 'A' gages . . . permanently sealed against dust and never handled by the operator . . . provide consistent precision.





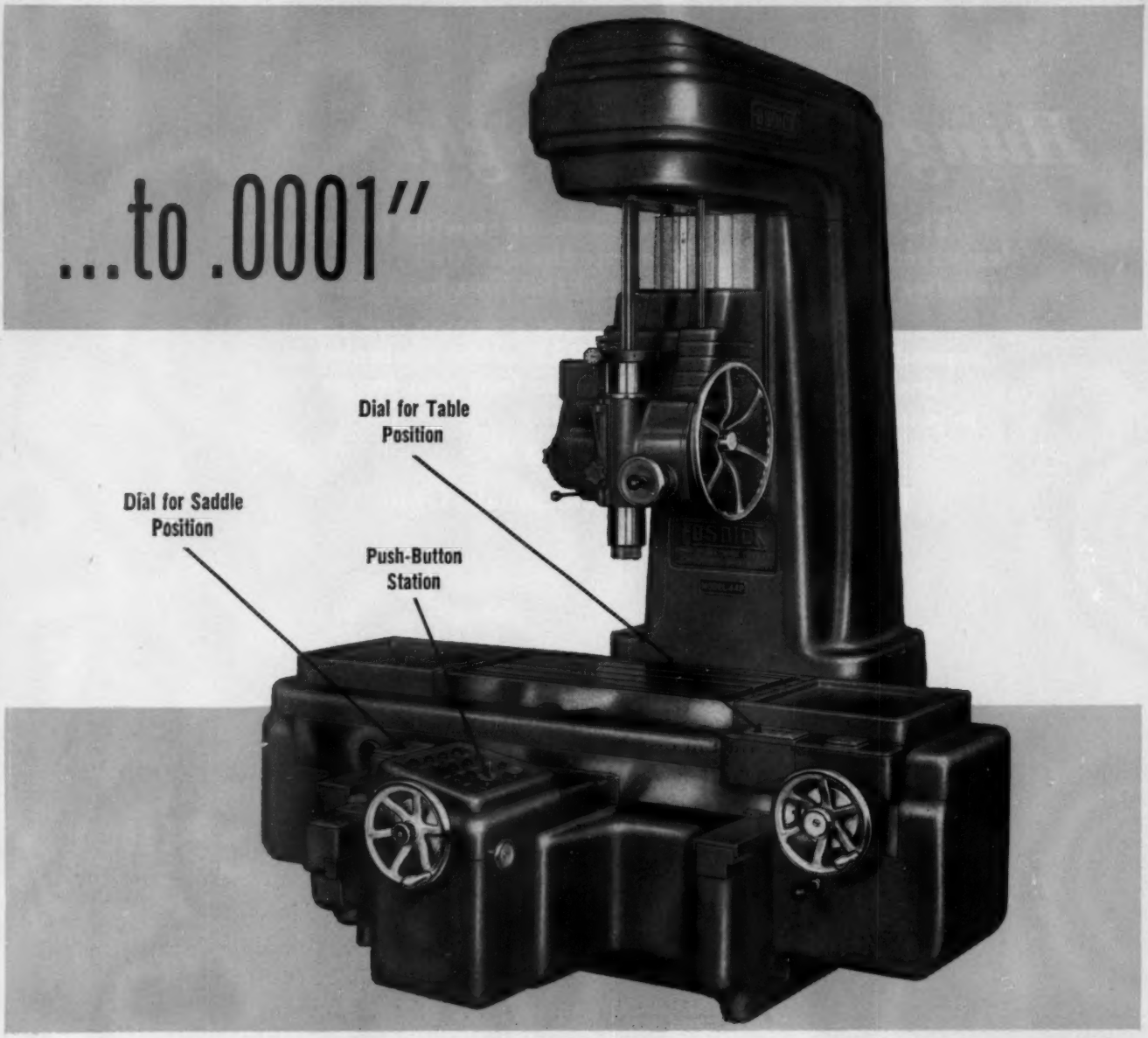
Press a Button . . . Table and Saddle Position Automatically!

Once dials are set, press the positioning button. Table and saddle will automatically position themselves to the dimensions set on the dials. We guarantee accuracy of ± .0001"!

In addition, push-button station controls spindle feeds and speeds; milling feeds to table and saddle; electric clamp to table and saddle; rapid traverse to table, saddle and quill; emergency stop.

NEED DRILLING EQUIPMENT? GET A PROPOSAL FROM FOSDICK!

...to .0001"

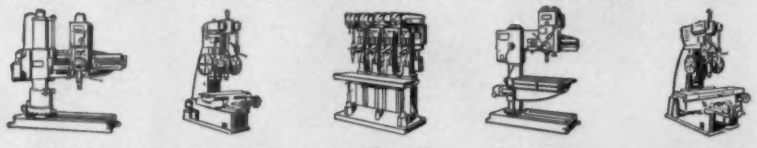


Like the scores of Fosdick Jig Borers in plants throughout the U. S., this new machine will perform consistently to ± .0001" . . . in measured table and saddle position as well as hole size. In addition, a new degree of speed and convenience has been attained in our exclusive Direct Dimension measuring system.

Other major advancements in this machine contribute to a long life of consistent precision performance. Our new quill bearing design locates ball races permanently at top and bottom of head, regardless of quill position. Gears are hardened and ground and are operated by magnetic clutches.

Other features include – 16 spindle speeds and 8 feeds, both *preselected* from push-button station. Rapid Traverse to head with electric clamping. Rapid traverse to quill (extra). Electronically-controlled milling feeds from ¾" to 15" per minute. Table sizes – 22" x 44", 22" x 54".

Write today for bulletin containing full description.

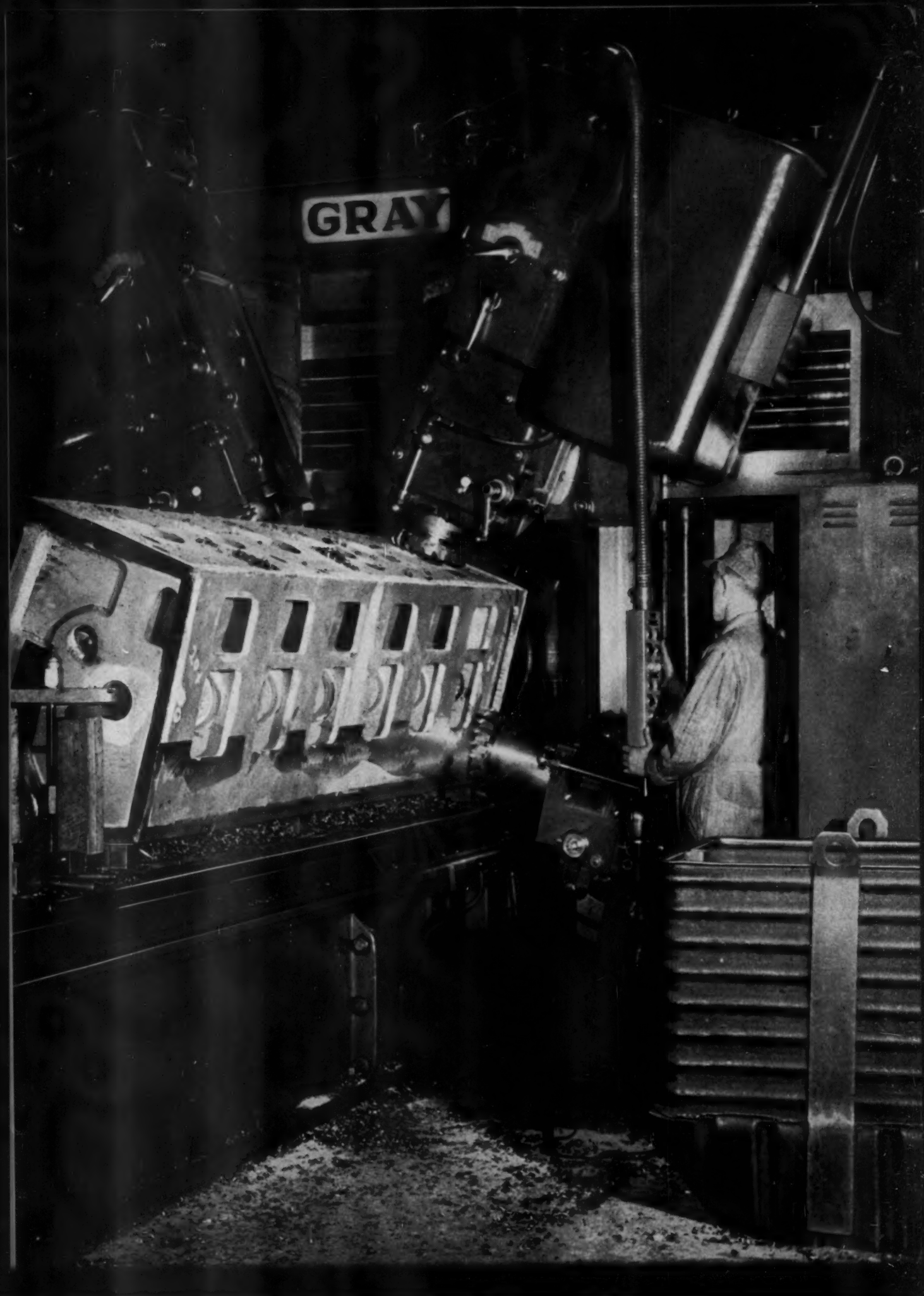


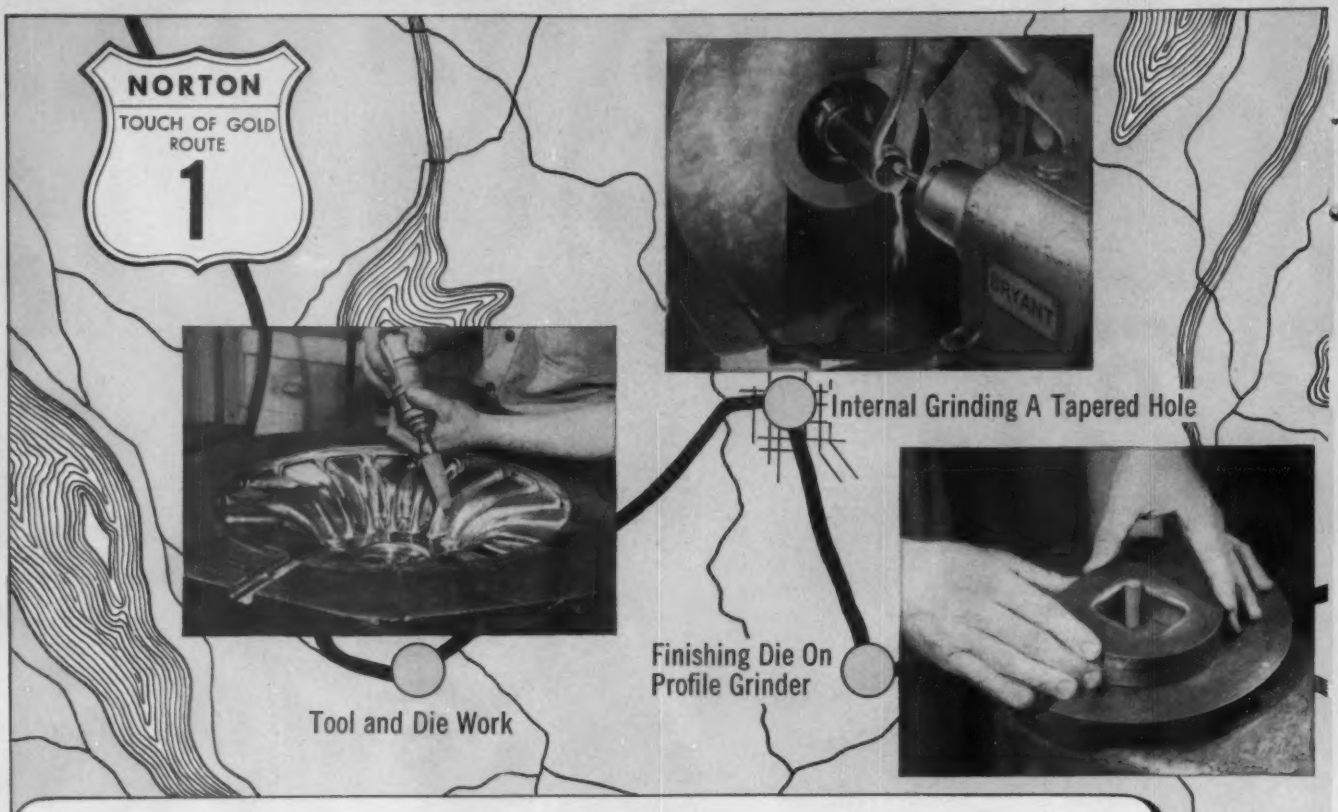
Radial Drills | Jig Borers | Sensitive and Upright Drills | Sensitive Radial Drills | Automatic Positioning Machines

FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

Hungry heavyweight
The GRAY Miller has an enormous appetite for large jobs.
Heavy feeds and big chips comprise the diet that
satisfies the continuous hunger of this unit head giant.
All this combined with super precision and traditional
dependability has established GRAY as the champion in
the heavyweight field. When you feed your tough
jobs to a GRAY Miller you'll see why . . .
Quality doesn't cost . . . it pays.
The G. A. GRAY Co., Cincinnati, Ohio


GRAY



YOUR "TOUCH of GOLD" ROAD MAP TO HARD-TO-REACH GRINDING SPOTS

NORTON MOUNTED WHEELS AND POINTS

bring you big savings on hundreds of small grinding jobs

Norton mounted wheels and points bring the same "Touch of Gold" grinding performance to small or hard-to-get-at areas that the big Norton wheels deliver in the "wide open spaces." Which means that every time you put one to work you get better grinding for less money. Here are some reasons why:

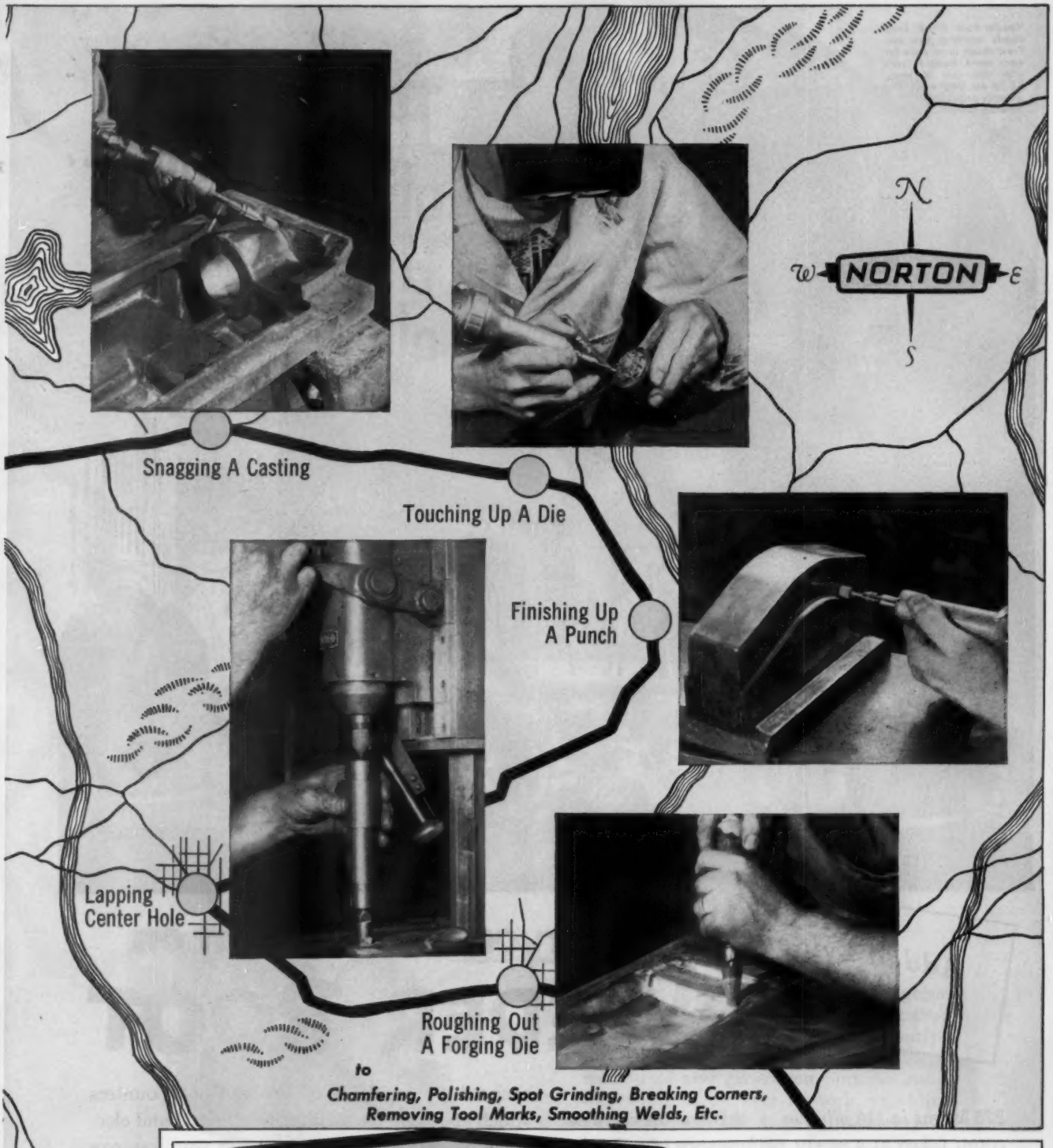
- ***Norton mounted wheels and points stay on their spindles — stay on TIGHT, under severest use. Norton-developed mounting techniques make sure of this.***
- ***They're trued on their own spindles, which assures: (1) perfect concentricity; (2) sharpness and fast-cutting action; (3) accuracy of dimensions and shape. They're ready to go to work immediately.***
- ***They're duplicated identically from lot to lot, thanks to Norton's statistical quality control in processing.***
- ***They're a 100% complete line, for grinding all metals and many other materials . . . made in nearly 200 standard shapes and sizes . . . in the famous ALUNDUM* and CRYSTOLON* abrasives, vitrified or resinoid bonded . . . in diamond abrasives, metal or resinoid bonded . . . and in the laminated, semi-flexible BF construction, resinoid bonded. For ultra-high speed precision grinding, special spindles and cement are available.***

Your Norton Distributor

can help you plan your profit-boosting "Touch of Gold" Route to hard-to-reach grinding spots. See him for the mounted wheels and points you need. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

W-1648



to
Chamfering, Polishing, Spot Grinding, Breaking Corners, Removing Tool Marks, Smoothing Welds, Etc.

NORTON

Making better products... to make your products better

and its BEHR-MANNING division

NORTON COMPANY: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

Veeder-Root Hand Tally counts anything you see. Press thumb lever once for each count. Reset to zero with one turn of knob. $8.30 ea. (Write for quantity prices.) Immediate delivery.

If this Clicks often enough... then the show clicks, too!

Added Evidence that—

Everyone Can Count on VEEDER-ROOT

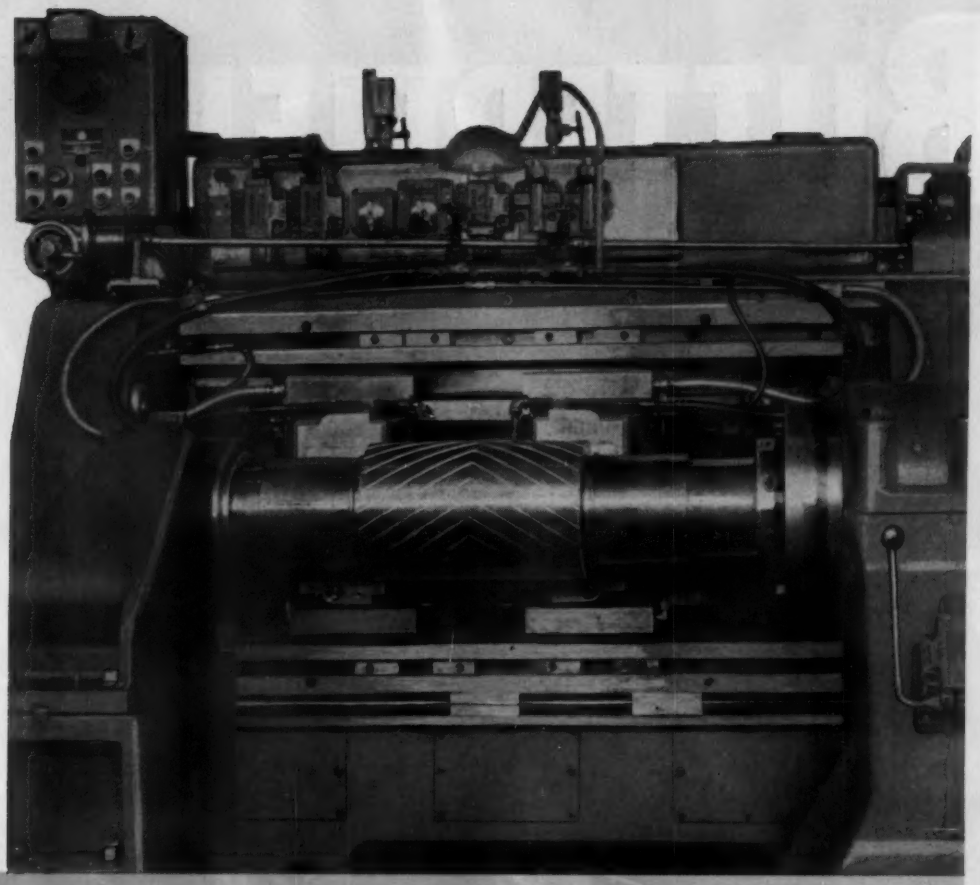
275 laughs in 113 minutes . . . this was the certified count taken at a recent performance of a Broadway show by two executives of Fact Finders Associates, Inc. . . . both using Veeder-Root Hand Tallies.

This is another one of the hundreds of uses for each of the hundreds of Veeder-Root Counters which are made for manual, mechanical and electrical operation. Chances are that *you*, too, can count on Veeder-Root . . . with counters built into your products as standard parts, or attached to your production equipment. We'll help you to figure out how. Write:

VEEDER-ROOT INCORPORATED
HARTFORD 2, CONNECTICUT

Chicago 6, Ill. • New York 19, N. Y. • Greenville, S. C.
Montreal 2, Canada • Dundee, Scotland
Offices and Agents in Principal Cities

"The Name That Counts"



Strength...going into a gear

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Cambridge (Mass.), Akron, Cleveland, Chicago, Los Angeles, Houston

Farrel-Birmingham®

FB-1016

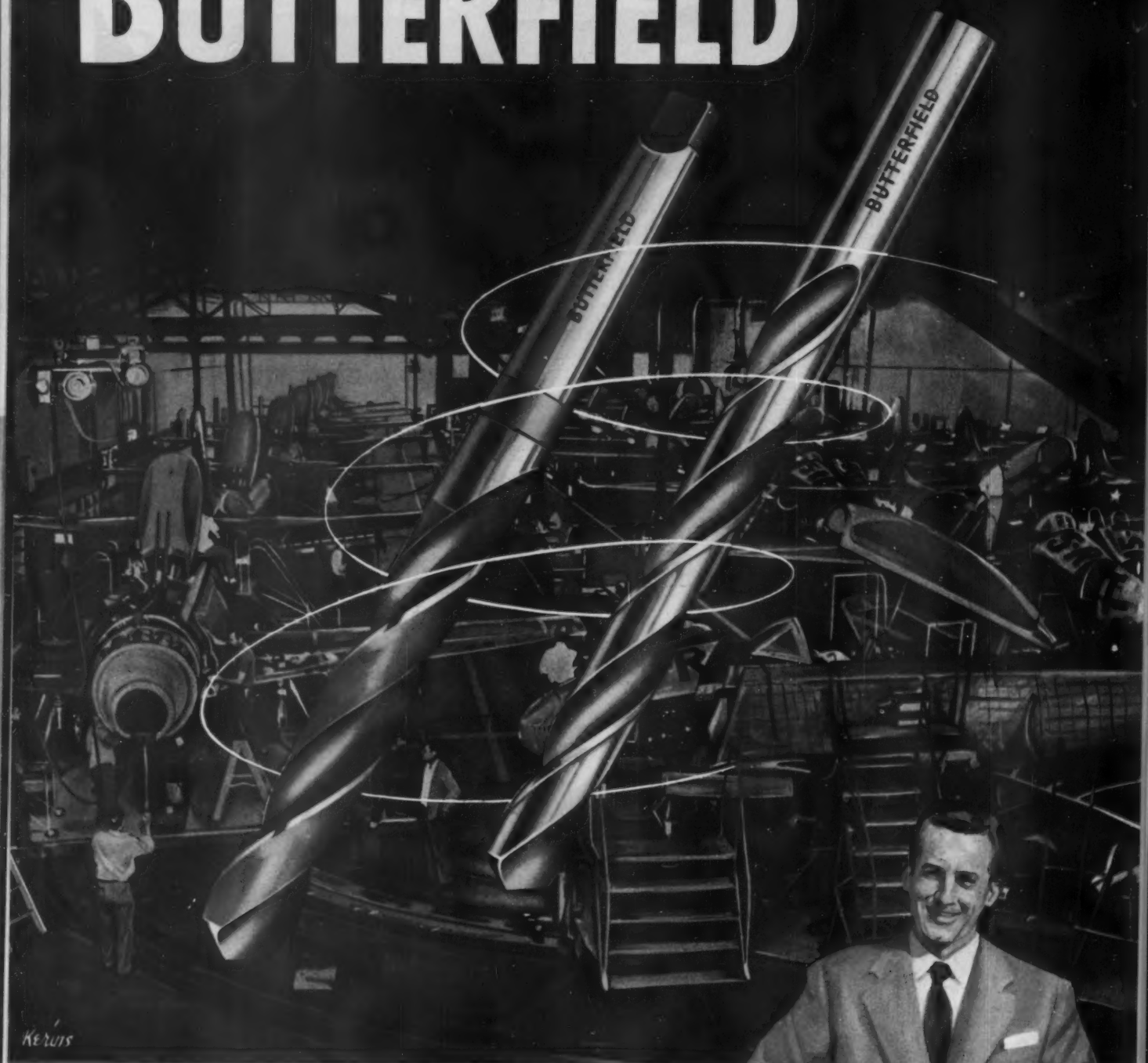
In the photograph, a Farrel-Sykes gear generator is cutting the two helices of a continuous-tooth herringbone gear, simultaneously—*without a center groove.* This unique method of gear generation puts the *entire* face width of the gear to work, providing extra strength and greater load-carrying capacity.

Extreme accuracy of tooth spacing, profile and helix angle is going into the gear, too. This pays off in smooth, quiet, uniform power flow and prolonged gear life.

The "Twin-Head" generator makes fast, simple work of cutting every type of herringbone gear, single helical and spur gears, two members of a cluster gear at the same time, and other toothed and cylindrical forms.

Write for details.

BUTTERFIELD

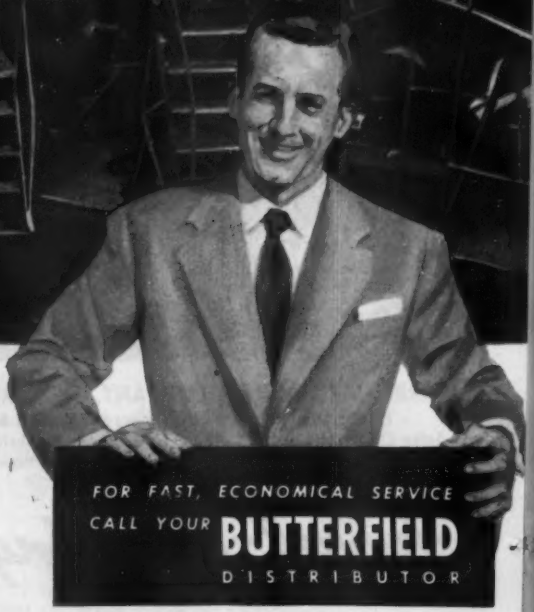


A COMPLETE LINE OF QUALITY cutting tools is now available from your Butterfield distributor. Drills are made to the same exacting standards as Butterfield Milling Cutters, Taps, Dies, Reamers, Counterbores and End Mills.

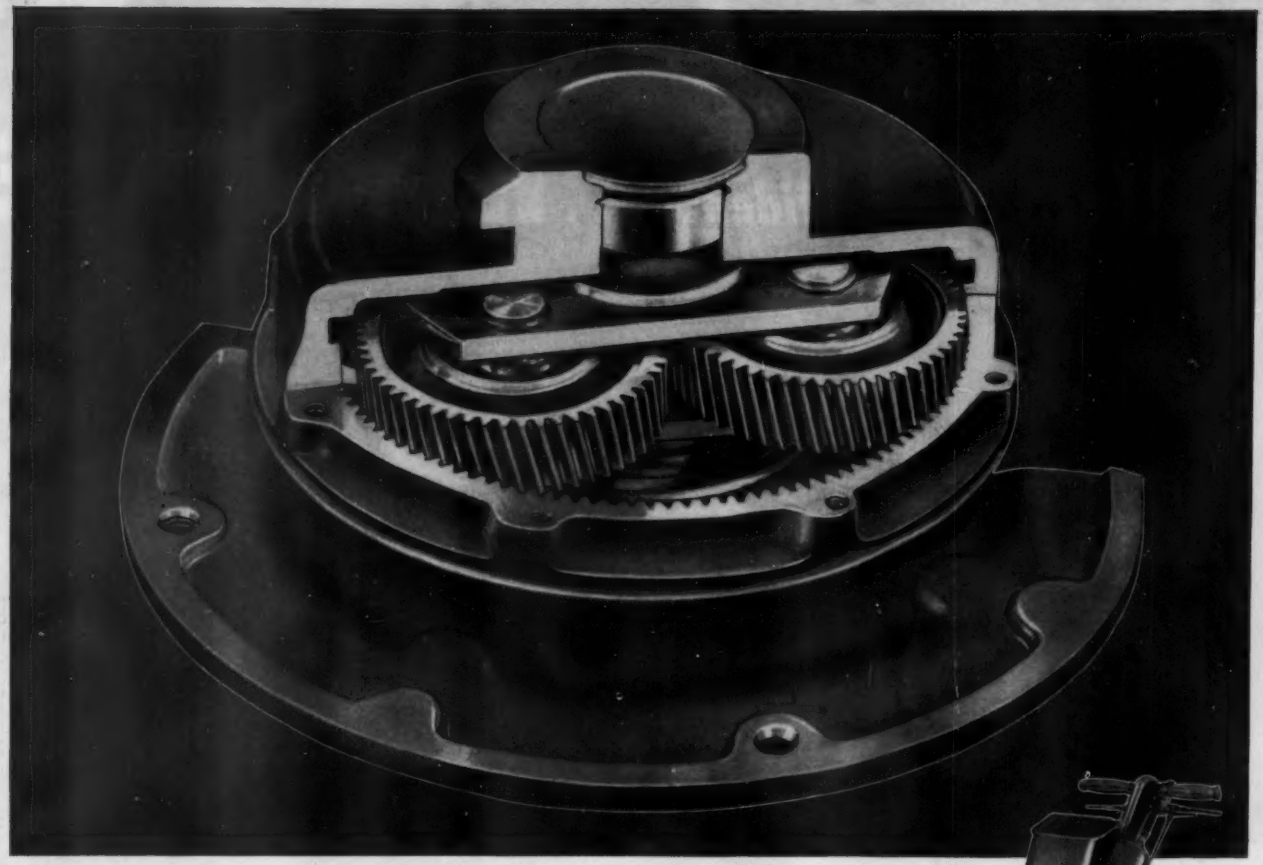
UNION TWIST DRILL COMPANY

BUTTERFIELD DIVISION

DERBY LINE, VERMONT, U. S. A.



FOR FAST, ECONOMICAL SERVICE
CALL YOUR **BUTTERFIELD**
DISTRIBUTOR



Superbly Machined G. S. Planetary Gearing Transmits Power in Clarke Floor Maintainers

Clarke Floor Maintainers take a terrible beating! Buildings use them night after night for years, with little or no down-time. Big contributor to the spectacular power, speed and low operating cost of this rugged machine is the Planetary Gearing *superbly machined* by G. S. ★ If you have power transmission problems in which Small Gearing is involved, check up now on *"G. S. Free Consulting Service"*. Let our specialists recommend the ONE best application for the job you describe. Write today!

SEND FOR.. *our 6-page Small Gearing Guide. It illustrates and describes over 80 different types and applications of G. S. Small Gears, from 8 to 96 dp. Ask for it on company letterhead, please.*

40 Years of Specializing in Small Gearing!

FRACTIONAL HORSEPOWER GEARS

GEAR Specialties, Inc.

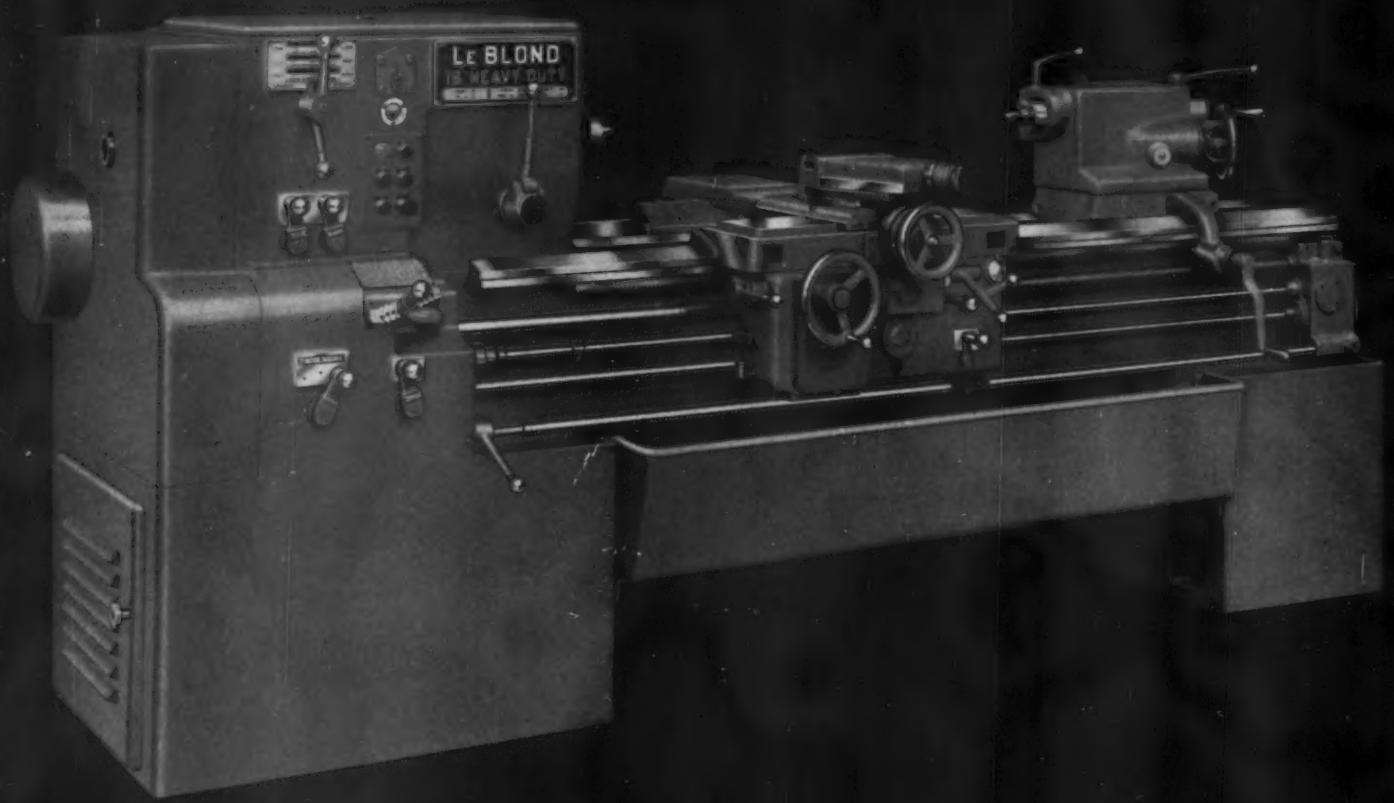
Spurs · Spirals · Helicals · Bevels · Internals · Worm Gearing · Racks · Thread Grinding

2635 WEST MEDILL AVENUE · CHICAGO 47, ILLINOIS

MEMBER OF

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

cut with confidence . . . **HERE'S THE**



New LeBlond 16" H.D. Heavy-Duty Lathe

NEW LeBLOND

16" HEAVY DUTY

stamina plus with precision

LeBlond heavy-duty engine lathes have always been known for their outstanding stamina—the inherent ability to stand up to the toughest turning jobs with precision, year after year. Our new 16" Heavy Duty is the most rugged, yet precise machine of its class that we've ever built!

The new headstock uses our proven combination gear-belt drive to give you a complete range of 27 spindle speeds from 16 to 2000 rpm chosen by direct-reading color plate. You get maximum power and smoothness from the 20-hp motor whether you're roughing or finishing—18 speeds are gear driven; 9 higher speeds are driven through a positive Gilmer-type belt that requires no adjustment. Free-running spur gear design assures minimum no-load friction horsepower . . . shafts and gears not needed for a given speed remain idle, do not consume power uselessly.

For a new degree of speed and convenience, a single lever controls the four-way power rapid traverse built into the apron. Both length and cross feed through a positive-jaw clutch are controlled by a single lever. Lubrication is entirely automatic. Bedways are hardened and ground steel inserts fitted to LeBlond's compensating veeway principle for better distribution of cutting forces. Quick-change box is totally enclosed. New tailstock uses the exclusive LeBlond thrust-lock design with a quick-set length dial.

For consistent and precise production, you can't do better than the new LeBlond 16" Heavy Duty. Call your nearby LeBlond Distributor or write for Bulletin HD-126A.

. . . cut with confidence

THE R. K. LEBLOND MACHINE TOOL COMPANY
CINCINNATI 8, OHIO

LeBLOND *of Cincinnati*

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • *FOR MORE THAN 68 YEARS*

Allis-Chalmers Induction Heaters

Cut Brazing Time 50%

and Increase Uniformity

The brazing alloy, in wire form, is clip shaped. Photo shows how clip is slipped over one edge of the blade. As alloy heats, at temperatures from 1350 to 1400 F, it flows around the entire base of the blade.

Here's what happened when a turbojet engine manufacturer replaced hand brazing methods with eight Allis-Chalmers Electronic Induction Heaters.

The work involved brazing shrouds to the tips of compressor blades.

Today, using the Induction Heaters and special fixtures, the job is performed in a continuous operation without pulsation or reheating of components. It takes only half the time formerly required. Brazes are more uniform and the average pull test loading is 33% above minimum of 2800 pounds.

Here's what Induction Heating can do for you...

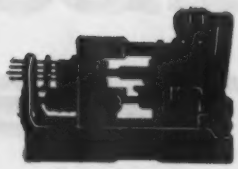
If your work involves brazing, soldering, annealing, heating or hardening — it will pay you to know about Allis-Chalmers Induction Heaters. In practically every installation they have resulted in substantial increases in production or product preference, and healthy cuts in material costs and rejects. See your nearby district office or write for details. Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4578

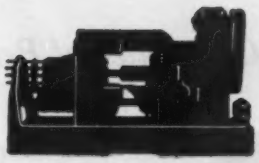
ALLIS-CHALMERS

with the addition of

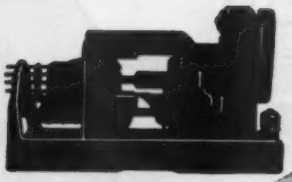
4 New Models



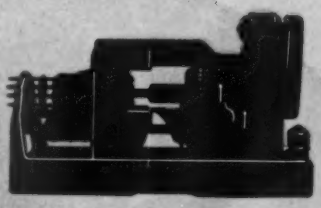
NEW 5/8" RA-8



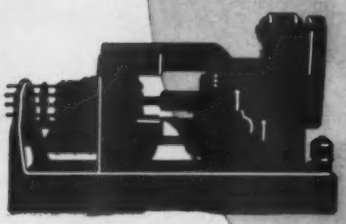
NEW 1¼" RB-8



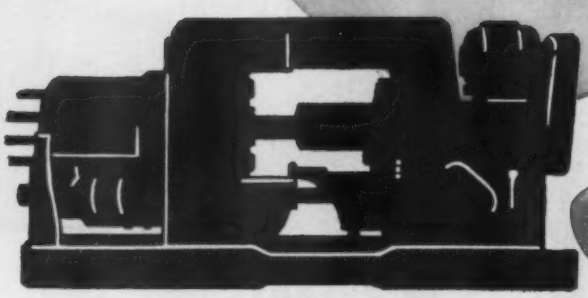
1⅝" RB-8



2⅝" RB-8



NEW 3½" RB-8



NEW 4" RB-8

Acme-Gridley 8-spindle advantages now extend to ALL ranges of bar work up to 4" diameters

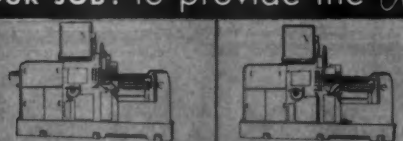
The principal performance advantages of Acme-Gridley 8-spindle bar automatics now can profitably be applied to bar work as small as the capacity range of a 5/8" machine and as large as 4" diameter. These advantages include:

- faster machining cycle time because of additional end working positions;
- "new machine" reliability longer—with carbide or high speed tooling;
- greater accuracy and uniformity of parts with fewer rejects;
- completion of a greater number of secondary operations in the primary machine setup (spindle stopping mechanism optional), with consequent savings in man hours, floor space and machine investment.

And for help-when-you-need-it, these new models (and all Acme-Gridleys) are backed up by a wealth of "*complete line*" tooling experience (literally thousands of tooling setups) plus a policy for service which has always played a mighty prominent part in maintaining National Acme's position of leadership.

It will pay you to plan your production the modern Acme-Gridley 8-spindle way. Why not ask us to tell you more about it?

OUR JOB: to provide the *Right Machine* for YOUR JOB



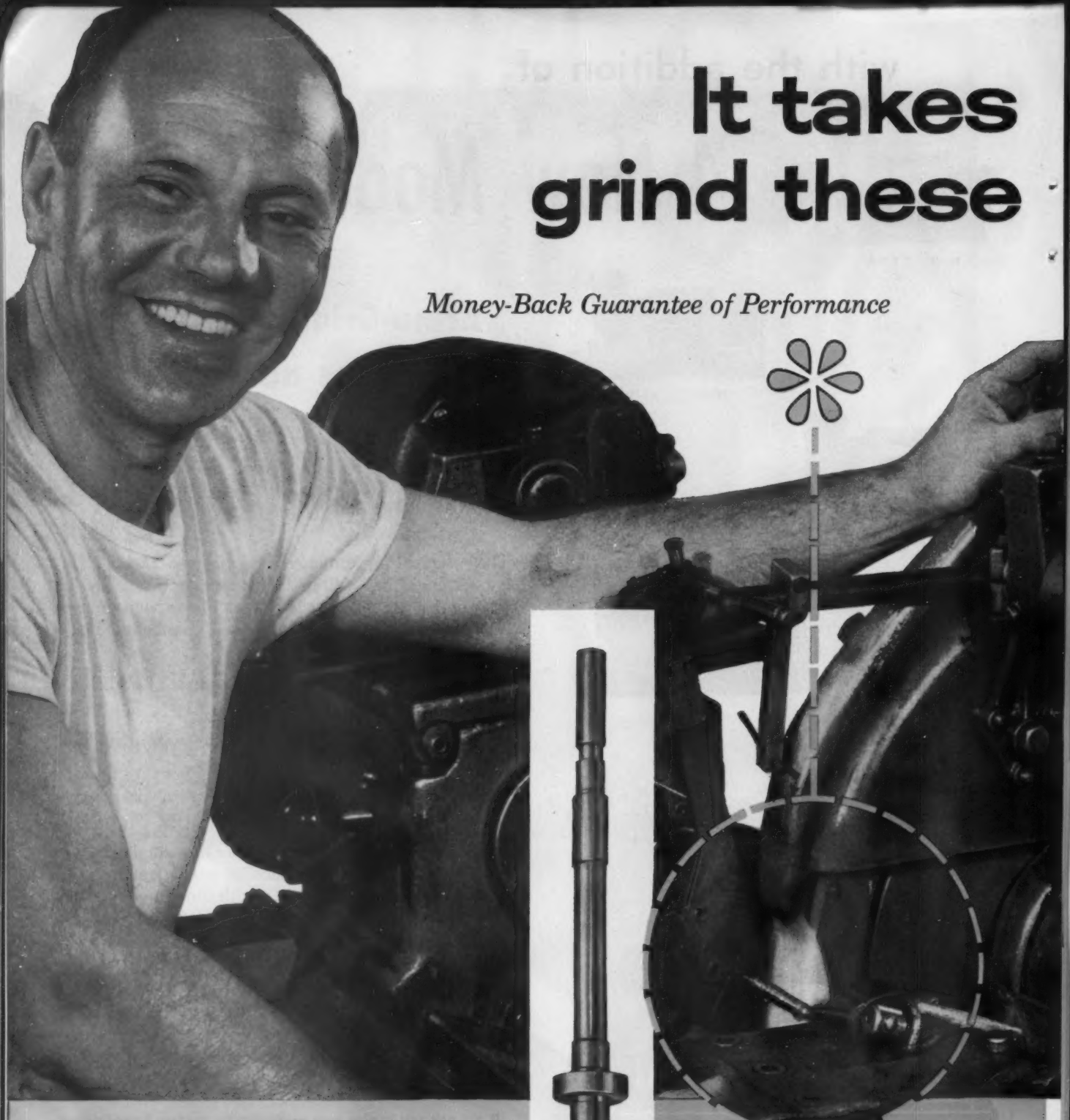
Acme-Gridley 4, 6 and 8 Spindle Automatic Bar and Chucking Machines • Fully Automatic Turret Lathes (Bar and Chuck Type) • Hydraulic Thread Rolling Machines • Automatic Threading Tools • Switches • Solenoids • Contract Manufacturing.

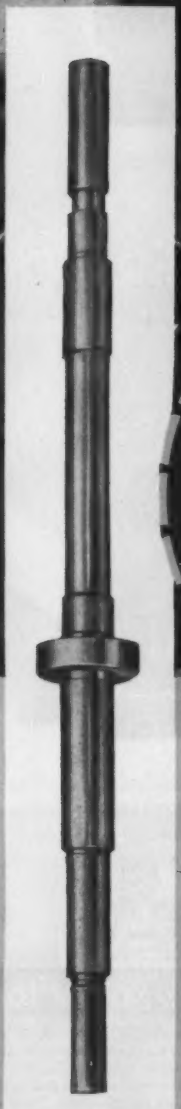
THE NATIONAL ACME COMPANY

171 EAST 131st STREET • CLEVELAND 8, OHIO

It takes grind these

Money-Back Guarantee of Performance





PROBLEM: Produce motor shafts to critical dimensions out of tough stainless steel. Because the shaft is long and thin, the coolant must minimize grinding wheel pressures to help overcome the natural "whipping" motion of the long part.

SOLUTION: Johnson's Wax-Cool, the water-soluble coolant with the money-back guarantee.

Yes, it takes superior Johnson's Wax-Cool to do this difficult grinding job. Wax-Cool's unusual lubricity and cooling ability eliminate high grinding pressures to permit the wheel to grind according to grade and help to eliminate both deflection and heat distortion. Wax-Cool also keeps wheels free-cutting to produce cooler parts with mirror-like finishes.

If Wax-Cool can do *this* difficult grinding job, think of the many ways it can help *you* in your shop.

PRODUCTS OF **JOHNSON'S WAX**

Johnson's Wax-Cool to stainless shafts!

Guarantee of Performance

WAX-CUT **WAX-COOL** **TL-131**

There is no risk in trying any of Johnson's Wax Cutting Fluids. The full purchase price will be refunded if any of the above products fail to meet the following conditions in your plant, in actual production:

1. Provide increased tool life.
2. Provide greater production where increased feeds and speeds can be employed.
3. Gain operator preference.

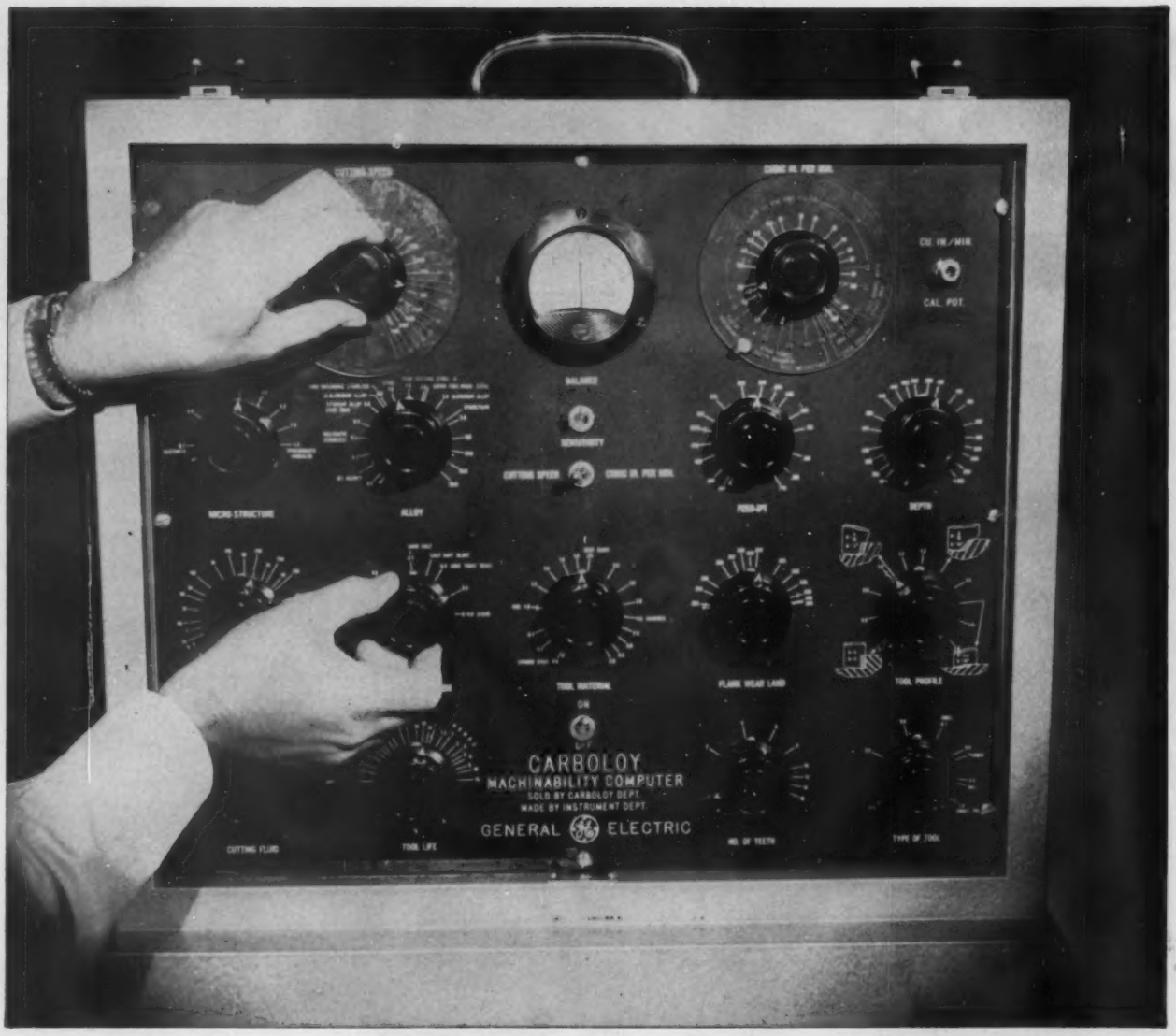
These three guaranteed advantages definitely increase the possibility of extra profits for your shop.

Johnson's Wax Cutting Fluids are carried in stock by a leading industrial distributor in your area. Your local Johnsón's Wax Industrial Distributor will be happy to arrange a trial in your shop . . .

For the name of the Johnson's Wax Distributor in your community, call Western Union by number and ask for

"Operator 25"

Carboloy announces the
CARBOLOY MACHINABILITY



To find an unknown variable like speed, output, or motor horsepower, simply set dials according to known information. Then turn dial of unknown variable until meter (top, center) balances at zero setting. Computer instantly shows what happens when any of the variables listed below are changed.

Computes values for any of these 19 operating variables:

Material Cut:
- Work material
- Microstructure
- Hardness
- Surface condition

Cutting Tool:
- Tool material
- Tool life
- Flank wear land
- Tool profile
- Type of tool
- Number of teeth

Cutting Conditions:
- Cutting fluids
- Feed
- Depth of cut
- Cutting speed
- Motor horsepower
- Cubic inches per minute
- Unit horsepower
- Work diameter
- R.P.M.

COMPUTER

- **New engineering tool solves complex machine setup problems in seconds, instead of hours**
- **Shows how to vary cutting conditions to increase machine, cutting tool, and operator efficiency**

In seconds, the low-cost Carboloy® Machinability Computer calculates the effect of 19 basic machining variables on machine performance, tool life, and output.

In seconds, it shows optimum operating conditions for any metal-cutting job, eliminating wasteful experimental runs.

In seconds, it shows how to improve existing setups by the right variation of operating conditions.

Easy to use

The Carboloy Machinability Computer is easy to operate. Anyone with machining experience can use it after a short familiarization period.

Results are numerical – requiring no further interpretation from the direct-reading dials. Accuracy is assured – based on more than a year's testing on in-plant applications at key General Electric plants.

Handles many jobs

The Carboloy Machinability Computer handles basic information on operating conditions, type and condition of work material, style and material of tools. The computer accurately predicts cubic inches per minute removed, tool life, and required machine horsepower. It shows how changing speed, feed, depth of cut, or tool material will affect these and other variables.

The Computer solves – in seconds – problems that would be otherwise impractical because of the large number of machining variables involved.

The Carboloy Machinability Computer was developed and proved in the field by a team of Carboloy and General Electric engineers, under the direction of Dr. W. W. Gilbert, of G.E.'s Manufacturing Services Division.

The Computer is portable (weighs only 32 lbs.), battery-operated, and measures 21″ x 7″ x 20″.

The price of the Carboloy Machinability Computer is ... **$495.** (f.o.b. factory, Detroit)

Whether your plant is large or small, the Computer can bring you immediate benefits. Send the coupon, below, for complete information.

TYPICAL IN-PLANT COMPUTER APPLICATION

PROBLEM: Setting up 16″, 10-HP lathe to turn hot-rolled 1020 steel bar with 10″ diameter, to get tool life of 1 hour.

SOLUTION: Starting from scratch on a new setup, *days* could be used by experienced tool men to find a satisfactory set of operating conditions . . . with no assurance that the result would be the best possible. With the computer, the optimum setup was established, and the effect of changing key variables compared, in less than *15 minutes.*

BENEFITS: Computer turned lengthy setup time into valuable production time. On this job alone, the savings gained through days of extra production, plus savings in manpower costs, would more than equal the cost of the computer.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY
11149 E. 8 Mile Ave., Detroit 32, Michigan

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

Please send me more information on the Carboloy Machinability Computer.

Name_____

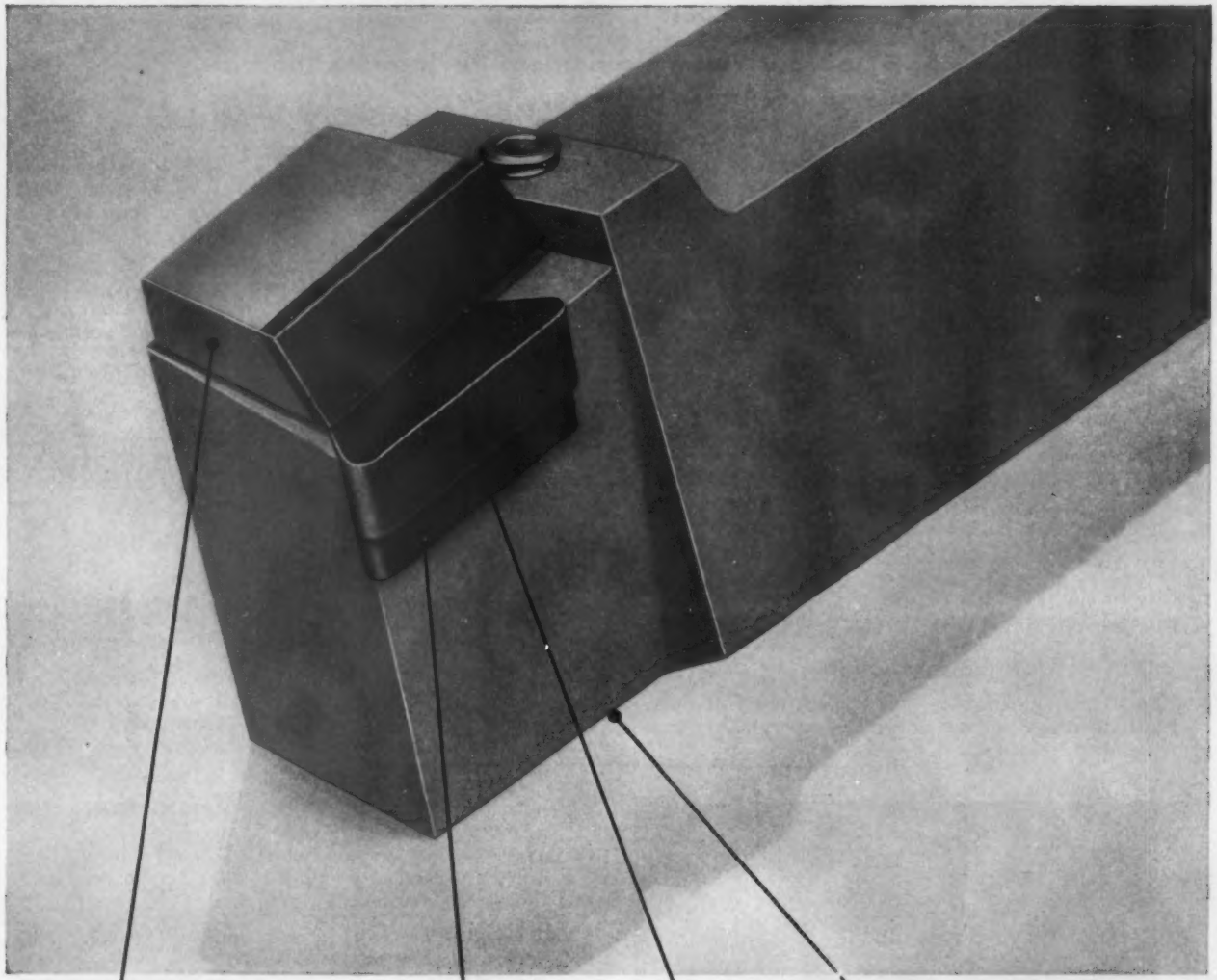
Company_____ Title_____

Address_____

City_____ Zone_____ State_____

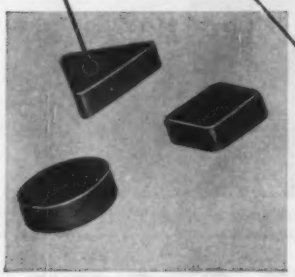
Carboloy announces

THE FIRST SIMPLE-TO-USE

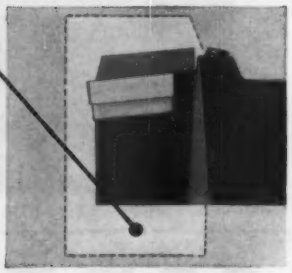


Clamp has built-in, wear-resistant carbide chip-breaker. Requires only light finger pressure to tighten; assures uniform chips, regardless of cut.

Indexable carbide pad is screwed to shank. Stays put while blank is indexed. Absorbs shock; decreases the possibility of holder damage.



Holders available for round, square, or triangular inserts. Expanded line of precision and utility blanks handle any machining job.



Unique design eliminates "club" below shank; reduces overhang to absolute minimum. Indexing is fastest, simplest ever, cuts changing time.

TOOLHOLDERS

- **Single adjustment screw indexes throwaway insert, sets chipbreaker . . . right in the machine**
- **Entirely new design reduces overhang, prevents chip interference, provides greater rigidity**
- **Carbide pad protects shank by absorbing shocks**
- **Heat-treated shank resists bending, deformation**

Exclusive clamping arrangement means you can index the blank, or turn it over – right in the machine – by simply adjusting a single screw at the top of the shank. The carbide chipbreaker is automatically set in the correct position.

Carbide pad cuts insert costs

The carbide pad allows more effective use of thin – and more economical – blanks. It gives greater rigidity; lets you use a harder grade of carbide, at greater speeds and feeds, to increase machine output at no extra cost.

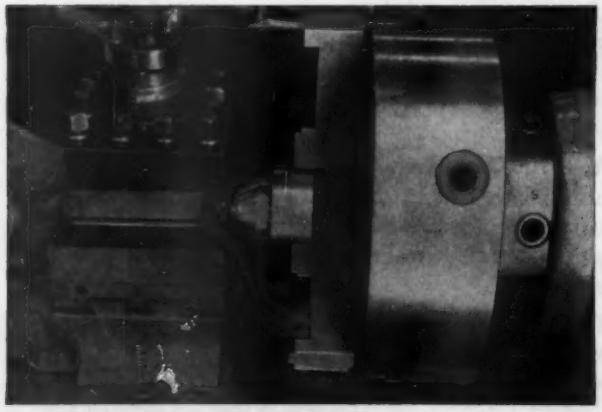
Exclusive Carboloy holder design has no projection below the shank, keeping overhang at a minimum and providing greater rigidity and accuracy. Minimum projection above the shank prevents chip interference and minimizes danger to clamp from flying chips.

Heat-treated shank gives the holder extra strength to resist deformation from clamp screw, and wear from chips.

Versatile holder design

This design is quickly adaptable to "specials" with cutting angles other than standard, to positive or neutral rakes. Also, it is especially adaptable for gang tooling.

The new holder is stocked in seven styles and 52 sizes – paralleling the styles and sizes of Carboloy braze-type tools. For complete details on these easy-to-use toolholders, send coupon today.



TYPICAL TOOLHOLDER APPLICATION

CONTOURING STELLITE VALVE. Round Carboloy insert is furnished precision-ground, eliminating costly grinding operation required for braze-type tools. Inserts on new Carboloy toolholder are indexed or turned over, right in the machine, reducing downtime. With Carboloy holders, only inserts are stocked, saving valuable toolroom space.

MAIL THIS COUPON TODAY

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY
11149 E. 8 Mile Ave., Detroit 32, Michigan

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

Please send me more information on the easy-to-use Carboloy Toolholders.

Name_____

Company_____ Title_____

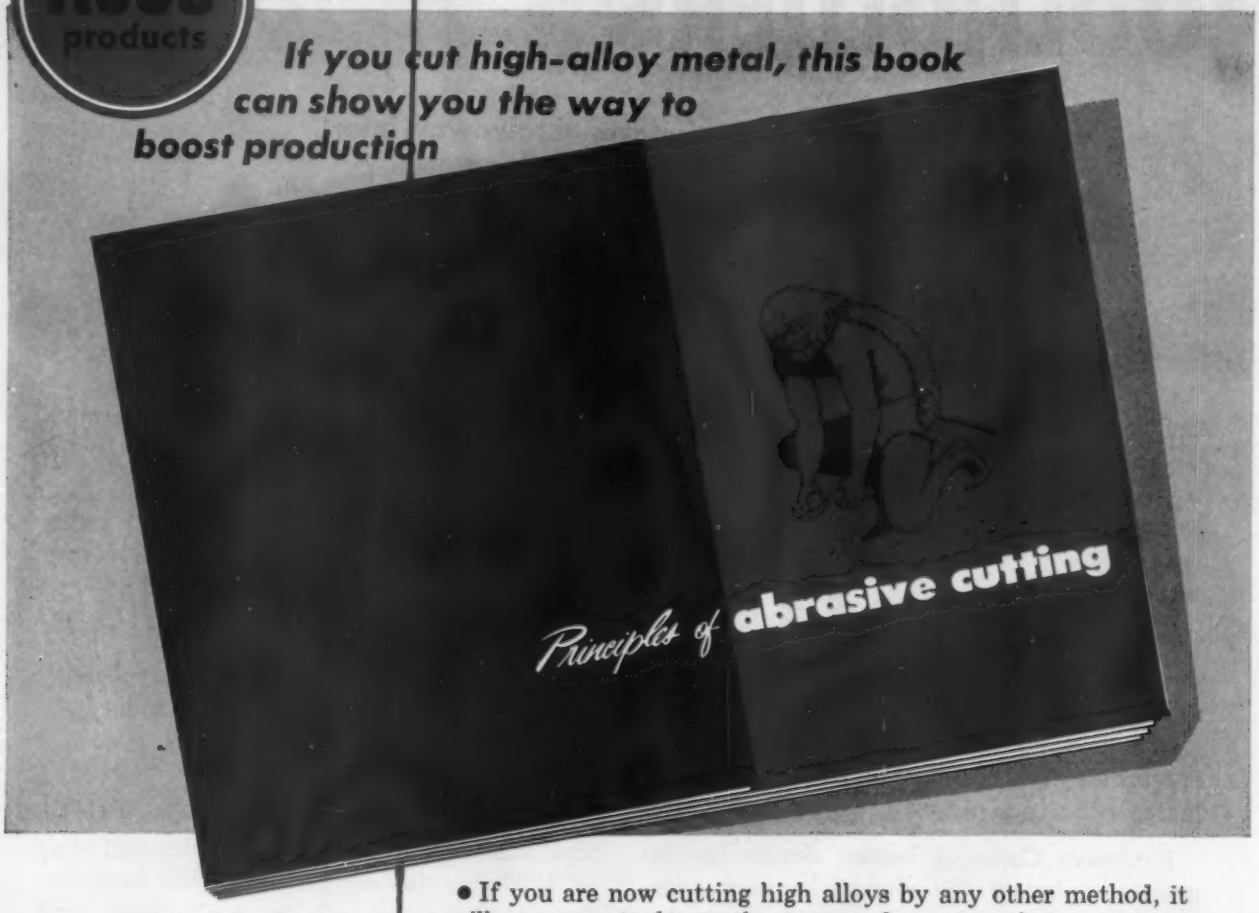
Address_____

City_____ Zone_____ State_____

Campbell Abrasive Cut-off Machines

ACCO products

If you cut high-alloy metal, this book can show you the way to boost production



CAMPBELL OFFERS WIDEST SELECTION OF ABRASIVE CUT-OFF MACHINES FOR EVERY NEED

Capacities—from 1" to 12" diam. solids

Hand-operated submerged cutting machines

Wet or dry machines for general shop requirements

Bar-cutting machines for continuous production

All-purpose wet abrasive horizontal cutting machines

Fully-automatic wet abrasive cutting machines

Hydraulically-operated, wet abrasive cutting machines

Rotary-oscillating-hydraulic wet abrasive cutting machines

• If you are now cutting high alloys by any other method, it will pay you to know the many advantages that CAMPBELL abrasive cutting can bring.

LOW COST FACTOR When cutting sections abrasively from bar lengths for forging, the metal may be purchased "unannealed." In some cases, saving the annealing cost will more than pay for cutting. Smooth cutting of abrasive process saves cost of smoothing operations. Accuracy of abrasive method reduces scrap loss.

HIGH QUALITY FACTOR High quality control standards are usually maintained by laboratory testing of specimen cuts. With abrasive cutting, metal can be cut in practically any condition—soft, hard, annealed or unannealed—with cut-off pieces ready for deep etching.

• Find out TODAY what the CAMPBELL methods can do for you. Testing procedure by CAMPBELL engineers will show conclusively whether abrasive cutting machines will save YOU money.

Write for **DH-301** *"Principles of Abrasive Cutting" today*

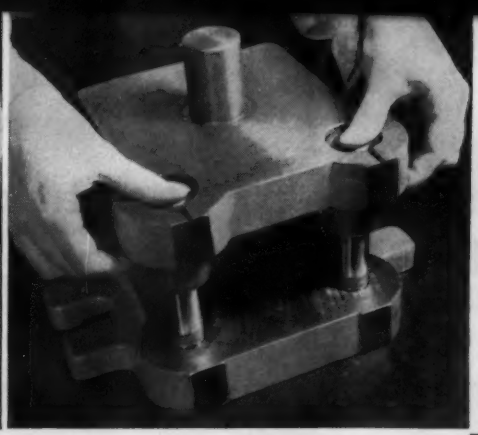
ACCO

TRADE MARK

Campbell Machine Division
AMERICAN CHAIN & CABLE

923 Connecticut Avenue, Bridgeport 2, Connecticut

Better Value



Here's a real test for quality...if you can make the punch holder glide up the pins just by squeezing—and hold its position without sinking back—it shows that the fit between pins and bushings is well-nigh perfect. The "finger-tip" action is typical of all DIECO die sets small enough to squeeze this way...and the larger ones are just as perfectly fitted.

What does "quality" in a die set mean to you?

If it means a perfect fit between pins and bushings...shoes that are absolutely parallel and stay parallel under load...*all* parts finished to precise tolerances with such unfailing regularity that there is never any variation in accuracy and serviceability among different die sets from the same source...then it stands to reason you must already be a user of DIECO die sets.

- Hardened steel pins superfinished and individually gaged to 0.0002" tolerance.
- High-tensile steel shoes, stress relieved and precision machined.
- Choice of bronze-plated bushings on hardened steel backing or hardened steel bushings—all with grease fittings. Precision ground and micro-honed to less than a "tenth" tolerance; can be arranged for pressure lubrication.
- Welded or screw shanks; any length guide pin.
- 1728 combinations in steel or semi-steel; interchangeable parts speed delivery.

E. W. BLISS COMPANY

BLISS SINCE 1857

DIE SUPPLY DIVISION

DIECO

1400 Brookpark Road,
Cleveland, Ohio

Industry's most complete line of die sets and die makers supplies

DIE SETS • GUIDE PINS • BUSHINGS • SPRINGS
SOCKET HEAD SCREWS • 5001 ITEMS

DIE SUPPLY PLANTS AND OFFICES

BUFFALO, N. Y.
440 Terrace Blvd., Depew, N. Y.
BURBANK, CALIF.
816 N. Hollywood Way
CHICAGO, ILL.
8033 South Kenton Ave.
CLEVELAND, OHIO
1400 Brookpark Rd.
DAYTON, OHIO
311 Vermont Ave.
DETROIT, MICH.
20201 Sherwood Ave.
PITTSBURGH, PA.
122 S. Sheridan Ave.
SAN JOSE, CALIF.
7th and Commercial St.

DISTRIBUTORS

BIRMINGHAM, ALA.
Ford Tool and Carbide Co.
3716 Tenth Avenue North
CAMDEN, N. J.
Fidelity Tool Supply, Inc.
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Midland Supply, Inc.
823 Rockford Rd., S.W.
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312 Laura St.

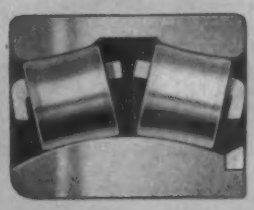
NEW! For severe impact and heavy loads LINK-BELT presents "MILL BEARINGS"

Link-Belt "Mill Bearings" are part of industry's most complete line of ball and roller bearing blocks.

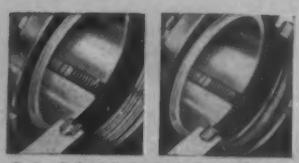
STEEL PILLOW BLOCKS are the answer wherever bearings must withstand great shock and impact loads—as on steel mill, foundry, oil drilling, mining, construction and other heavy-duty equipment. That's why Link-Belt offers this line of Mill Bearings.

Perhaps your bearing demands are less extreme. Whatever your need, you'll find the right answer in this complete line of pillow blocks . . . plus flange, flange-cartridge, cartridge, take-up and hanger blocks and self-aligning roller bearings. Ask your nearest Link-Belt office or authorized stock-carrying distributor for a copy of the helpful 120-page Data Book 2550 on the full line, and 8-page Book 2565-A on Link-Belt "Mill Bearings."

All these important differences are found only in Link-Belt "MILL BEARINGS"

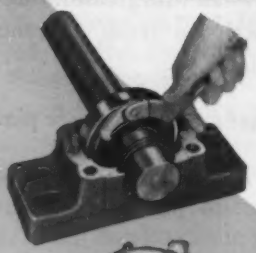


FREE-ROLLING SELF-ALIGNMENT. Adjusts immediately in all directions, assuring full load capacity, even when subjected to shaft deflections and inaccuracies of mounting. Important because "Mill Bearings" are subject to heavy, sudden shock loads.



Left, Spiral Labyrinth Steel Seals for heat conditions, oil or grease lubrication. Right, Contact Type Seals of felt laminated with synthetic rubber for dusty conditions, grease lubrication.

ONE BASIC HOUSING accommodates either type of seal shown at left. They keep lubricant in and dirt out.



EASY INSTALLATION AND MAINTENANCE. Removal of cap means removal of bolts and hence no interference with assembly and inspection.

SUPER-RUGGED STEEL HOUSING. Four large heat-treated thru-bolts lock with heat-treated alloy steel serrated nuts to firmly clamp cap and base, permitting maximum radial and thrust loads. Big base area supports the bearing and withstands the extremely heavy pounding of mill and other grueling operations.

13,710-AB

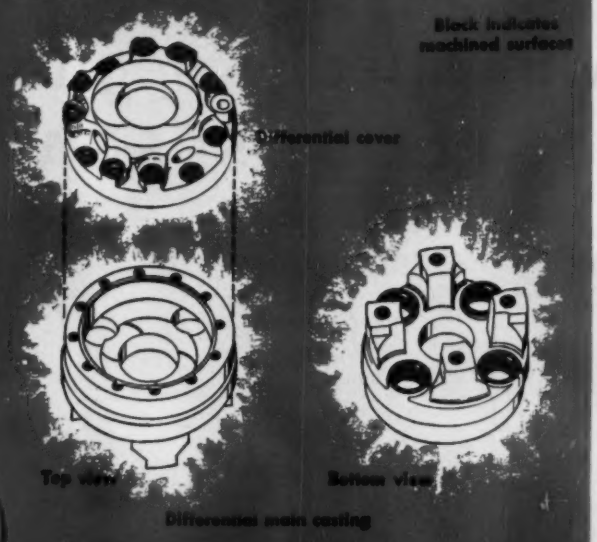
LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 13,710-A

LINK-BELT

Ball and Roller Bearings

CUSTOMER SPECIFIED

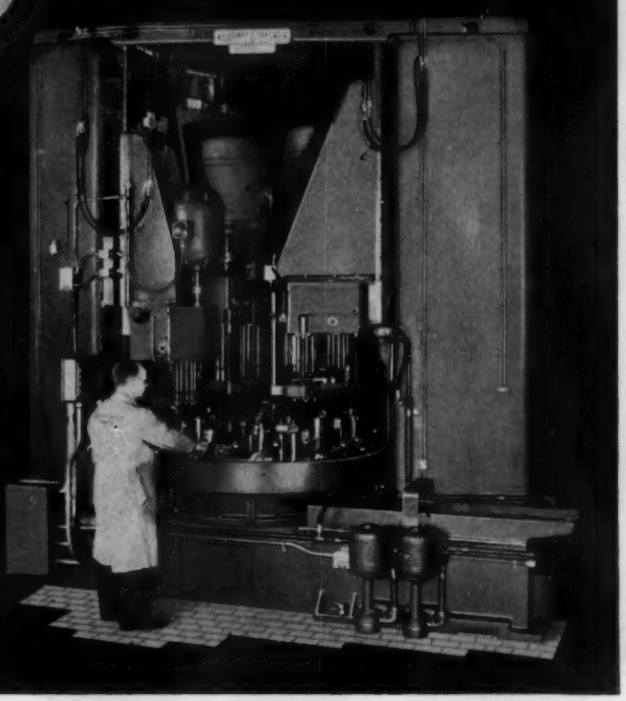
Customer specified a multi-purpose production machine to perform 12 operations in sequence on both the main casting as well as the cover of a differential housing.



KEARNEY & TRECKER DESIGNED

Kearney & Trecker designed this new 88-spindle drilling and tapping machine to complete 134 pieces per hour, 67 covers and 67 main castings.

Machine features rugged columns which provide rigid support . . . and exacting accuracy. Five fixtures, each holding three workpieces, are mounted on a standard Kearney & Trecker 60" rotary index table. Machine employs three vertical drilling heads, each counterweighted. First head has 48 spindles and performs drilling, counterboring, flat bottom drilling and chamfering. Second head carries 28 spindles and handles spotfacing, reaming, boring and trepanning operations while head No. 3 with 12 spindles does tapping operations.



New production efficiency starts with Kearney & Trecker Milwaukee machine tools

This new machine proves that you can rely on Kearney & Trecker's Special Machinery Division to give you the highest production possible at lowest cost. Because with more than 50 years' experience in machine design and manufacture, Kearney & Trecker Corp. has all the ingenuity and skill required to solve high production machining problems.

Why don't you take advantage of our abilities? They can pay off in profits for you. Your Kearney & Trecker Special Machinery Division representative will be pleased to give you all the details. Contact him today!

For more details on the machine illustrated ask for Data Sheet No. 1052. Also, free booklet "Doorway to a proven method for solution of big and small metalworking problems" is yours for the asking.

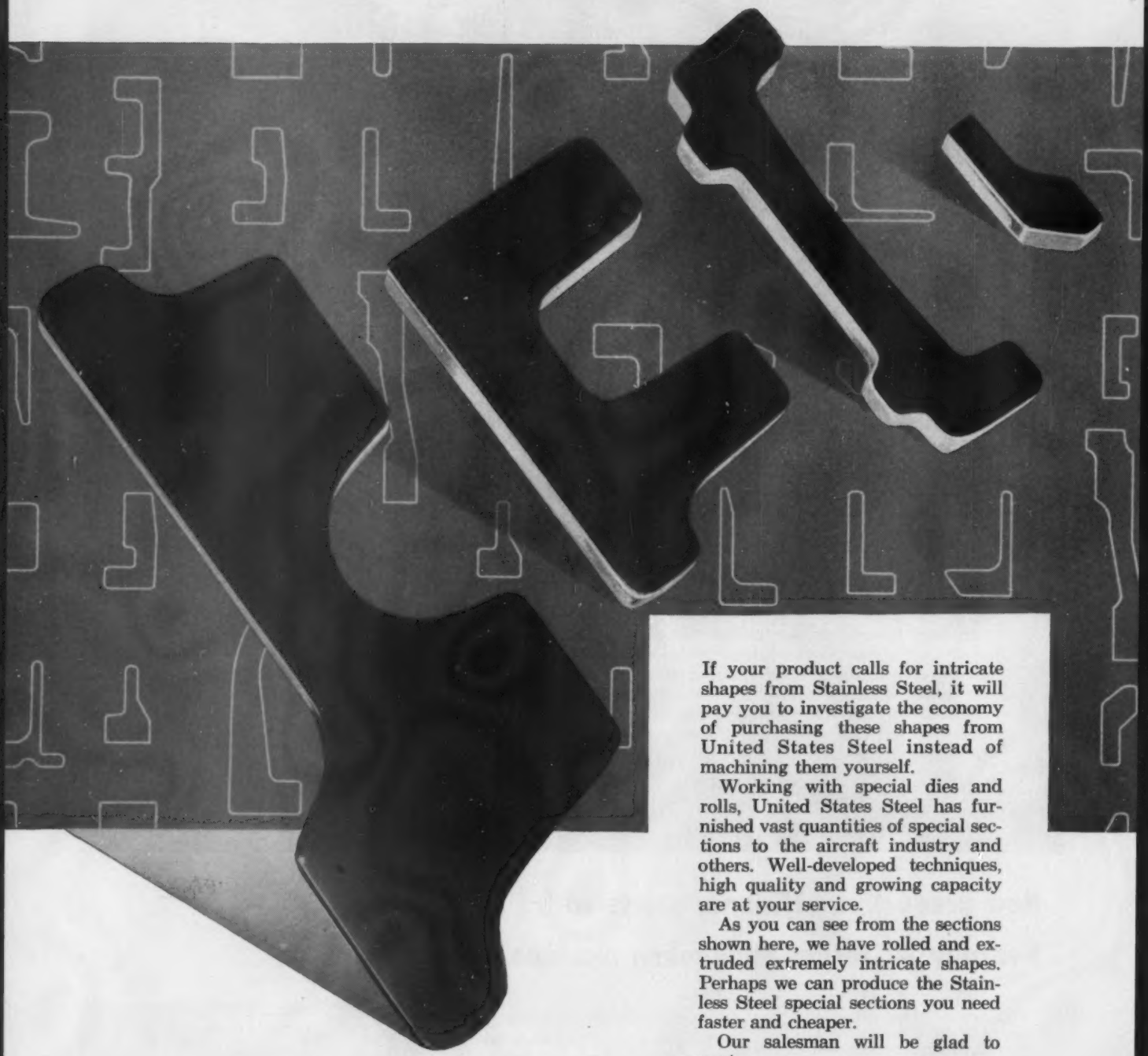
KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

Special Machinery Division

MILWAUKEE 11, WISCONSIN, U.S.A.

Builders of Precision and Production Machine Tools Since 1898

You can save machining costs with special sections–rolled or extruded of **USS STAINLESS STEEL**



If your product calls for intricate shapes from Stainless Steel, it will pay you to investigate the economy of purchasing these shapes from United States Steel instead of machining them yourself.

Working with special dies and rolls, United States Steel has furnished vast quantities of special sections to the aircraft industry and others. Well-developed techniques, high quality and growing capacity are at your service.

As you can see from the sections shown here, we have rolled and extruded extremely intricate shapes. Perhaps we can produce the Stainless Steel special sections you need faster and cheaper.

Our salesman will be glad to quote.

USS STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

USS

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

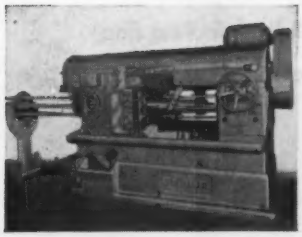
UNITED STATES STEEL

First with NEW "Automatic" Service

Cone was the first builder of multiple spindle automatics to provide machine users with an experimental service in the application of carbide tools.

This service is a practical means of determining the possibilities of carbide tools for production men without loss or interference with their regular production schedules.

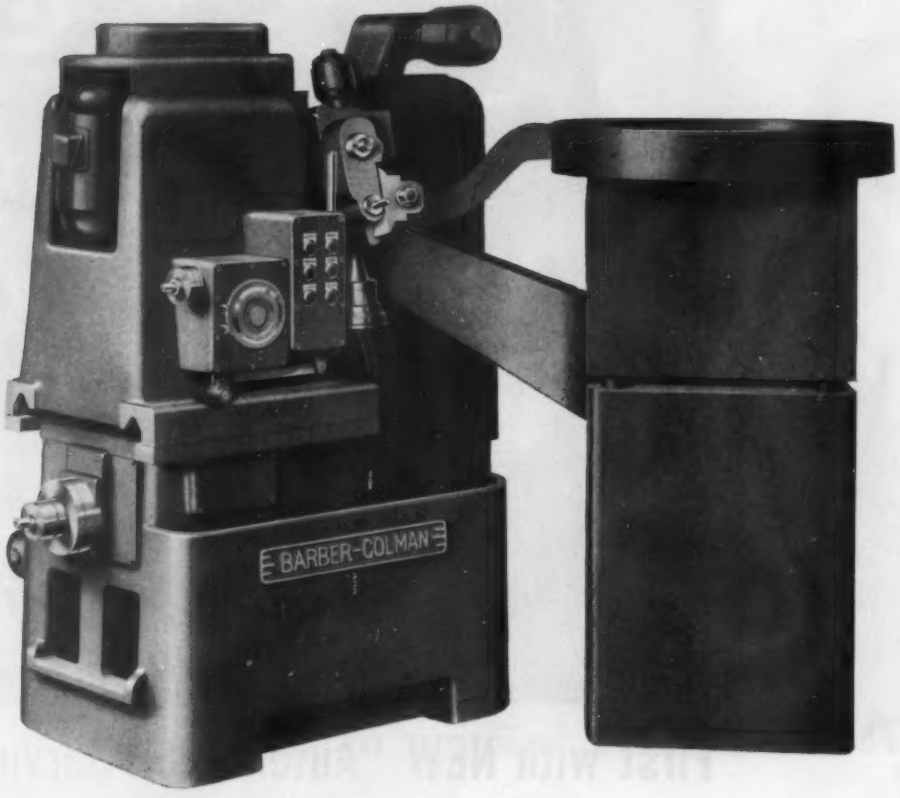
A pamphlet "FOUR STEPS WITH CONE" describes this service. Send for your free copy.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

a NEW automatic high-speed hobbing machine...



The Barber-Colman No. 3-6 Vertical Hobbing Machine is a single-purpose machine designed and built to meet the requirements of a specific job. The machine has standard basic elements, but the tooling, loading, gaging and handling are designed for maximum production of a specific part. Its high-speed operation makes it adaptable to all mass produced parts up to 3" diameter by 6" face width. Maximum pitch capacity is 10 DP. Hob speed for carbide hobbing of non-ferrous and non-metallic blanks are available. Features which contribute to the high-speed operation of this machine include exceptionally large heat-treated and ground bed ways, short drives to the work and hob spindles, and a hardened and ground multiple-thread index worm.

BUILDERS OF PRECISION GEAR

BARBER • COLMAN

No. 3-6

for high production gear cutting with automatic handling, loading and gaging

automatic loading	Blanks are automatically loaded from a vibratory hopper loading device. However, the type and variety of loading and handling devices with which this machine can be equipped are almost unlimited. Loading can be by magazine or conveyor when required.
automatic gaging	The gaging mechanism segregates gears of the correct size from those that are oversize or undersize. Size inspection is made by measuring over balls. If a pre-determined percentage of gears are out of tolerance, the machine can be made to stop automatically. The gaging unit can be furnished to inspect almost any elements of the gear.
automatic hob shifter	The automatic hob shifter can be set to shift a certain amount after each cycle, or it can be arranged to shift after a certain number of parts have been cut. Shifting increments can be changed easily by means of a graduated dial. The hob slide is clamped pneumatically.
centerdistance adjustment	The hob is set to the proper depth by means of a centerdistance adjusting mechanism, eliminating the usual time-consuming method of setting the hob to depth. The hob is placed in a fixture, and an indicator finger is set against the outside diameter. The indicator is calibrated to show the centerdistance between the work and the hob. This centerdistance setting is made by means of a graduated dial on the machine.

Some basic machine facts:

- Short, Compact Drives to Work and Hob Spindles
- Anti-Friction Work and Hob Spindle Bearings—Tapered Roller Type
- Pneumatic Work Clamping
- Self-Contained Lubrication and Coolant Supply
- Heat-Treated and Ground Bed V-Ways
- 2 HP, 1800 RPM Drive Motor
- Unitized Construction

HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 6110 ROCK STREET, ROCKFORD, ILL.

HOBS AND MACHINES SINCE 1911

two new Hendey lathes...

32-Speed Geared Head Lathe

This completely new lathe has a 32-speed headstock with the top eight speeds obtained through a belt drive to assure smooth finish on the work. This machine is equipped with a 15 HP motor, and spindle speeds up to 1500 RPM are available. It is designed to accommodate a 20 HP motor for spindle speeds to 2000 RPM. It can be furnished in 13", 16" and 20" sizes. Exclusive induction hardened and precision ground bed ways provide maximum accuracy and long life. Other features include 66 thread and feed changes, an independent lead screw, automatic lubrication, high-speed reversing mechanism, precision automatic stops, and heavy-duty, two-speed tail stock.

for greater accuracy and production

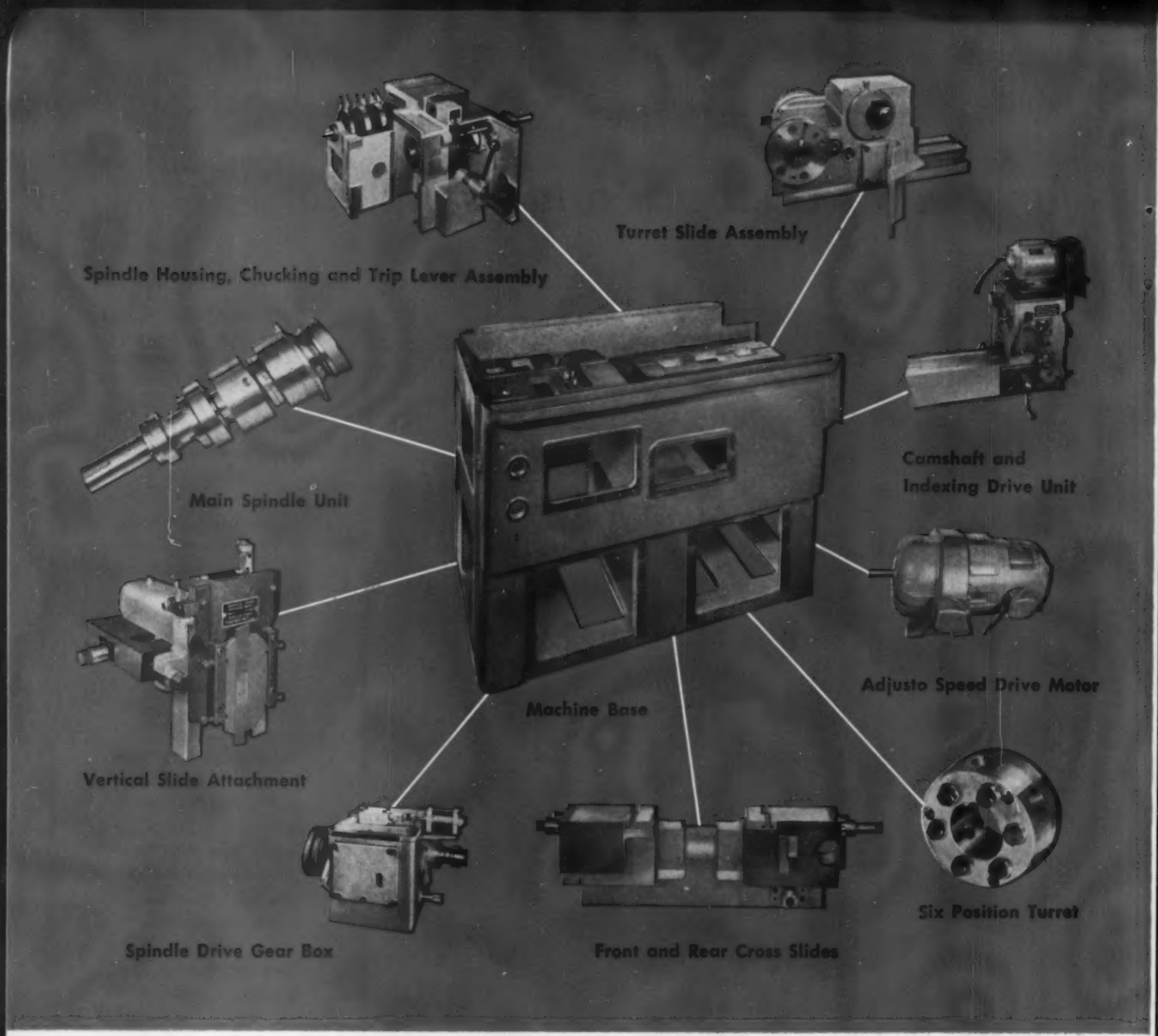
These new modern lathes are Barber-Colman's answer to any questions concerning the future of the Hendey line. They are proof of the strides we have already made and indicate the continued progress which we guarantee in the future. For years Hendey has had a reputation for accuracy. Now, new machines and features provide even closer limits of accuracy and greater production. Electronic and magnetic amplifier drives, induction hardened and precision ground bed ways, and a 32-speed geared head-stock are only a few of the new features available on Hendey lathes. See these new machines in action to determine how they can fill your production requirements.

No. 2E Precision Lathe

The new No. 2E Hendey Lathe is a 14" general-purpose precision lathe equipped with "Selectronic" control of spindle speeds. The electronic unit provides closer control over cutting speeds and full torque at slow speeds. It is an exclusive Hendey feature and is custom built for this lathe. Speeds may be pre-set or changed while cutting, and they are infinitely variable from 15 RPM to 1500 RPM. Low speeds are available through back gears. The spindle starts, stops, and reverses with a single lever control. Other features include dynamic braking, automatic lubrication, precision spindle bearings, and hardened and ground bed ways.

Hendey **machine division**
BARBER-COLMAN COMPANY
115 LOOMIS ST., ROCKFORD, ILLINOIS

BARBER COLMAN



DECREASE CAPITAL EXPENDITURES WITH THIS NEW OBSOLESCENCE-PROOF DESIGN . . .

Users of single spindle screw machines have long wanted a machine that would be obsolescence-proof. Here it is—the Detroit Screwmatic 750.

Here is how the Screwmatic's "unit-construction" holds down capital expenditure in future modernization programs. Ten individual units, including the machine base, comprise the Screwmatic 750. When technological improvements or innovations are introduced, they too will be designed in units. The user need only change that unit to have the latest in screw machines—at a nominal cost.

"Unit-construction" is but one of the innovations that Screwmatic brings to the screw machine field. Lower operating costs and high speed production result from these five principles:

- **Infinitely variable spindle speed drive allows exact cutting speed for the job.**
- **Silent V-belt drive to work spindle allows smoother turning and higher speeds.**
- **Stock feeding is through low pressure air cylinders assuring more accurate feed out length.**
- **Standard size collets and feeders are used.**
- **The open front, high wall cabinet gives maximum tool accessibility, effective oil splash protection, and free flow of chips.**

YOU'LL LIKE TO DEAL WITH US

You'll like our way of servicing customers. And you'll be dealing with a company known for its accomplishments in precision, speed, and automation in the field of gear grinding . . . a company that produces the intricate Rzeppa Constant Velocity Universal Joints.

HOW SCREWMATIC'S

"UNIT-CONSTRUCTION"

GIVES YOU AN EVER-MODERN SINGLE SPINDLE AUTOMATIC

DETROIT Screw Matic 750

NEW BROCHURE AVAILABLE

Includes full description of "unit-construction" principle, specifications, list of standard equipment, photographs and descriptions of outstanding features.

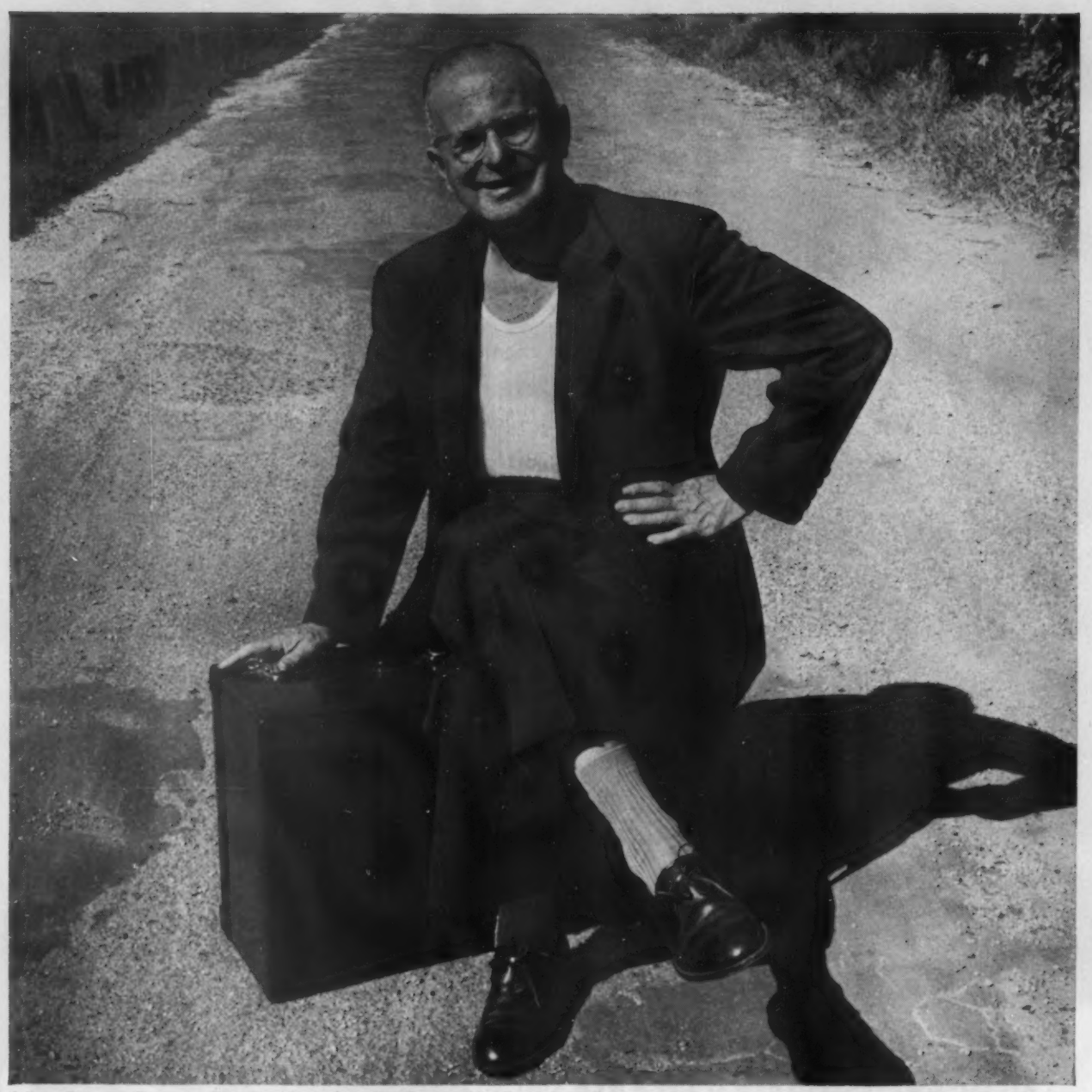
DEALERS NOW DEMONSTRATING. Write for name of dealer nearest you.

A PRODUCT OF

THE GEAR GRINDING MACHINE COMPANY

3919 CHRISTOPHER, DETROIT 11, MICHIGAN

MANUFACTURERS OF:
- Fully Automatic Gear Grinding Machines
- RZEPPA (pronounced "Sheppa") Constant Velocity Universal Joints



Sylvan Geismar, Executive Vice-President of the Manhattan Shirt Company, tells you

"How to lose your shirt on the road!"

"On October 4th, our salesmen take to the road in the annual race for Spring orders. And it's a tough race. If every sample isn't up-to-the-minute in style, we can lose our shirt!

"But we keep our Manhattan and Lady Manhattan salesmen out in front – with Air Express!

"As trends unfold, we deliver the newest shirt-styles to our men in a few hours. When hot items sell out, we fill buyers' re-orders just as fast! Air Express is indispensable in maintaining our leadership with our retail accounts.

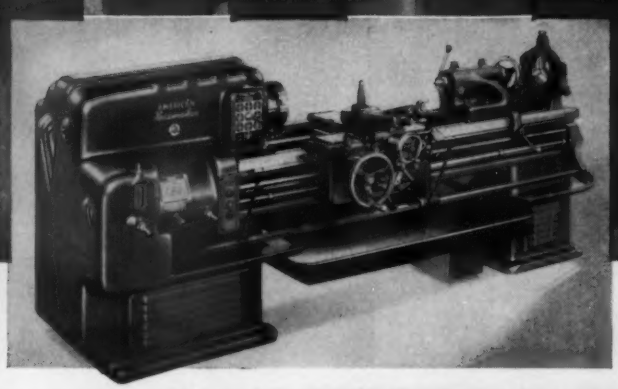
"Yet we save money on most of our Air Express shipments! A 15-lb. shipment from New York to Milwaukee, Wisc., for instance, costs $5.15. That's the lowest-priced complete service by $1.85!"

Air Express

GETS THERE FIRST *via U.S. Scheduled Airlines*

CALL AIR EXPRESS . . . *division of* RAILWAY EXPRESS AGENCY

"a wonderful job..."



Mr. Ray Hogan of McGee & Hogan Machine Works, Salt Lake City, Utah says "Your machines are doing a wonderful job for us."

This company uses "AMERICAN" Lathes and Radial Drills. It is known throughout the inter-mountain territory as a leader in metal working contracting, enjoying a reputation for low cost and quality second to none.

The accompanying illustration shows one of their 20-inch heavy duty "AMERICAN" Pacemaker Lathes chasing a large screw for a customer who has suffered a breakdown on one of his machines. The factor of time, cost and quality are paramount on a job of this kind. Mr. Hogan says his "AMERICAN" met this challenge one hundred percent.

Whether your work is production, maintenance or tool room, the power, ruggedness, range and stabilized accuracy of "AMERICAN" Pacemaker Lathes meet each and every requirement.

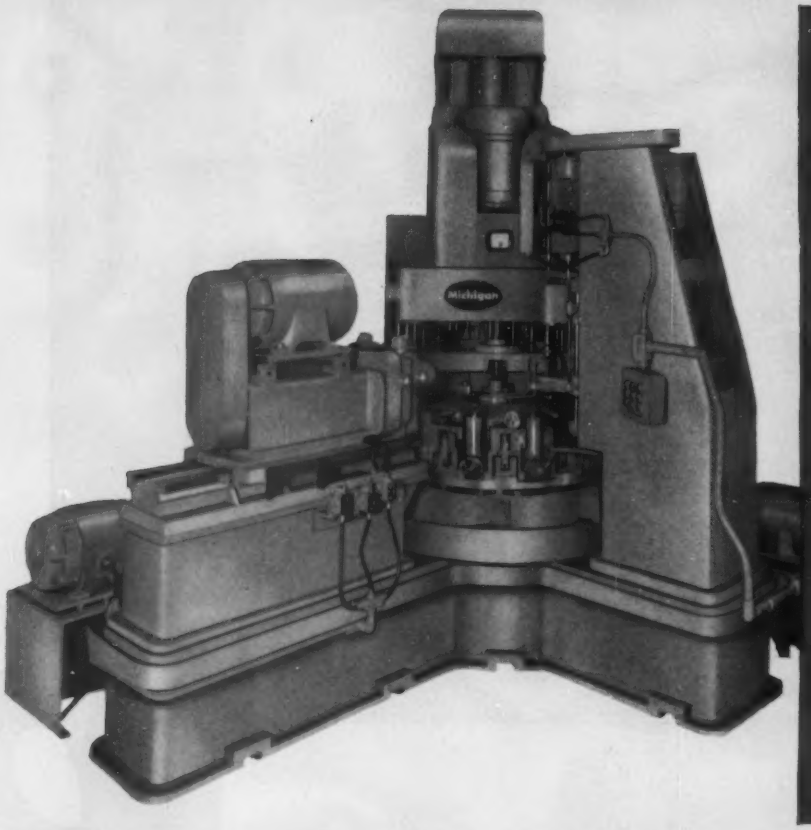
Send for bulletin No. 16 and get the facts.

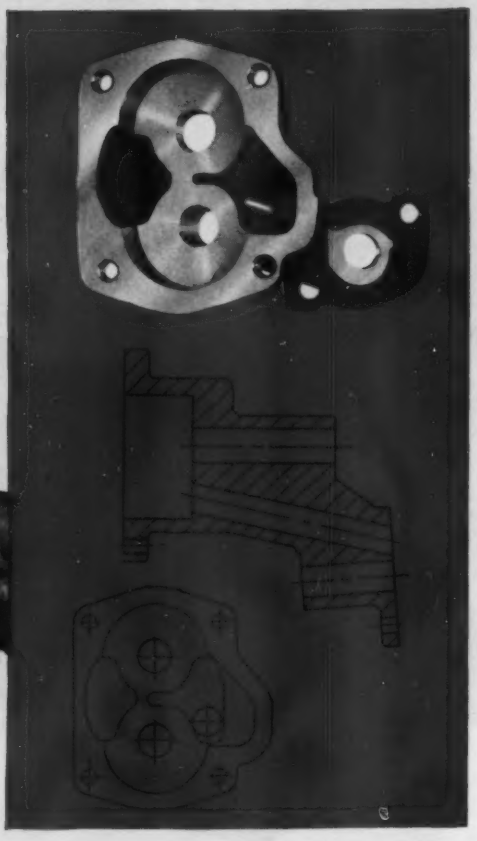
THE AMERICAN TOOL WORKS CO. **Cincinnati, Ohio U.S.A.**

Lathes and Radial Drills

Here's a Production Team

120 OIL PUMP BODIES



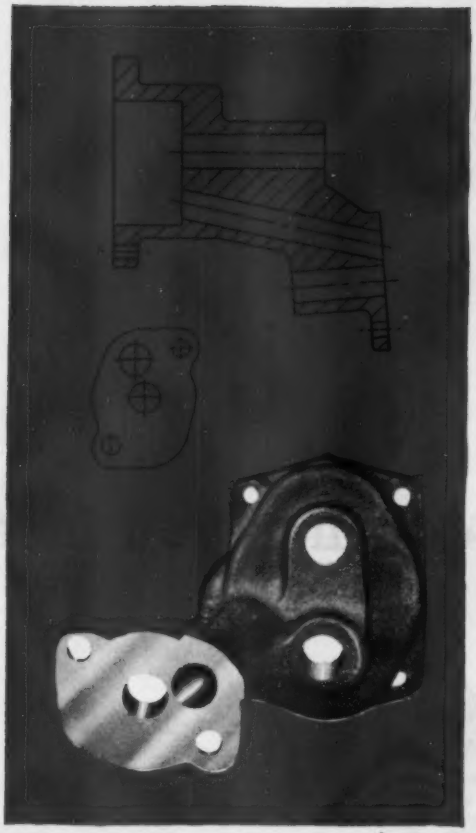


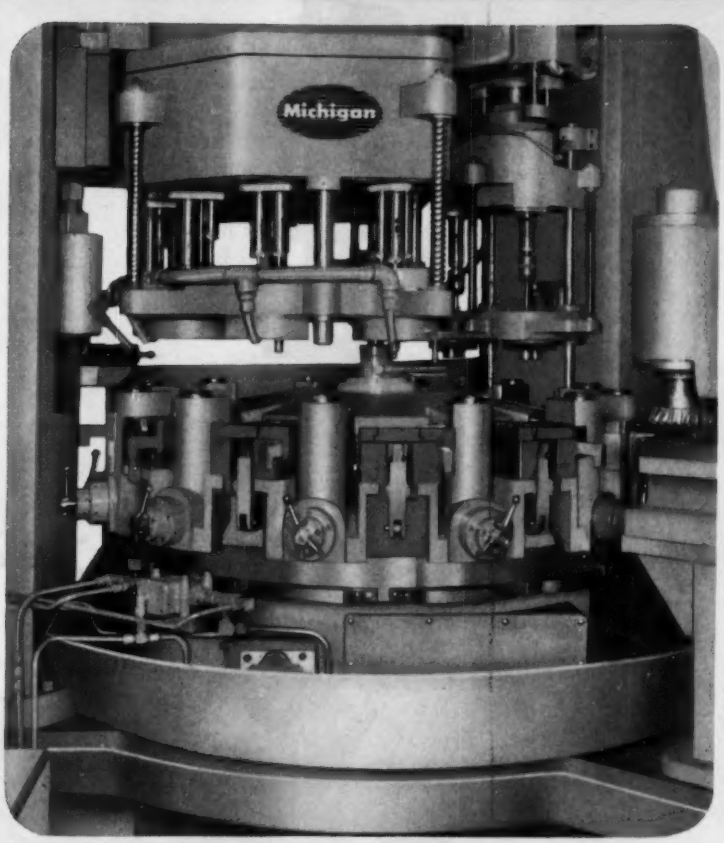
AUTOMATED OPERATIONS ON MACHINE NO. 1		
1. Rough mill the top face.	5. Chamfer the .4845 hole; Chamfer the first (2) mounting holes; and, rough bore one gear pocket.	8. **Finish bore** and square bottom other gear pocket.
2. **Finish mill** the top face.		9. Tap all (4) mounting holes in top face.
3. Drill thru the .4845 hole; and, tap drill (2) mounting holes.	6. Chamfer the .4785 hole; Chamfer the other (2) mounting holes; and rough bore the other gear pocket.	10. **Finish ream** the .4845 hole.
4. Drill thru the .4785 hole; and, tap drill (2) mounting holes.	7. **Finish bore** and square bottom of one gear pocket.	11. **Finish ream** the .4785 hole.
		Ready for Second Machine

For Faster, More Economical Production

That Will Slash Your Costs!

Completely Finished EVERY HOUR





AUTOMATED OPERATIONS ON MACHINE NO. 2

1. Straddle mill the outside lower face; and, inside lower face.	**4.** Drill the 15/32 hole thru.	**7.** Drill the 7/16 hole thru.
2. Finish mill the outside lower face.	**5.** Finish ream the (2) .2491 mounting holes.	Completely Finished.
3. Drill (2) .2491 Mounting holes.	**6.** Drill the 7/16 hole halfway thru.	Ready for Assembly.

AND THEY'RE FINISHED READY FOR THE PRODUCTION LINE

Michigan

We invite your inquiries regarding our full line of tapping units, and index tables, manual and automatic. Write for Catalog and Engineering Data Sheets.

DRILL HEAD CO. Detroit 34, Michigan

engineers and manufacturers of production machines and drilling equipment

what can you do when you face

When competitive pricing forces you to cut costs and replace money-losing machinery, the actual replacement cost may be greater than the depreciation reserve. Worse still, "reserves" may be on paper instead of in the bank, and the old machines may not make the down payment.

Don't wait for this kind of sudden obsolescence to hit.

Invest now in fast-earning, high yield Avey drilling machines, which sometimes pay for themselves in 9 months, generally less than 18 months—and then help build reserves for other needed equipment.

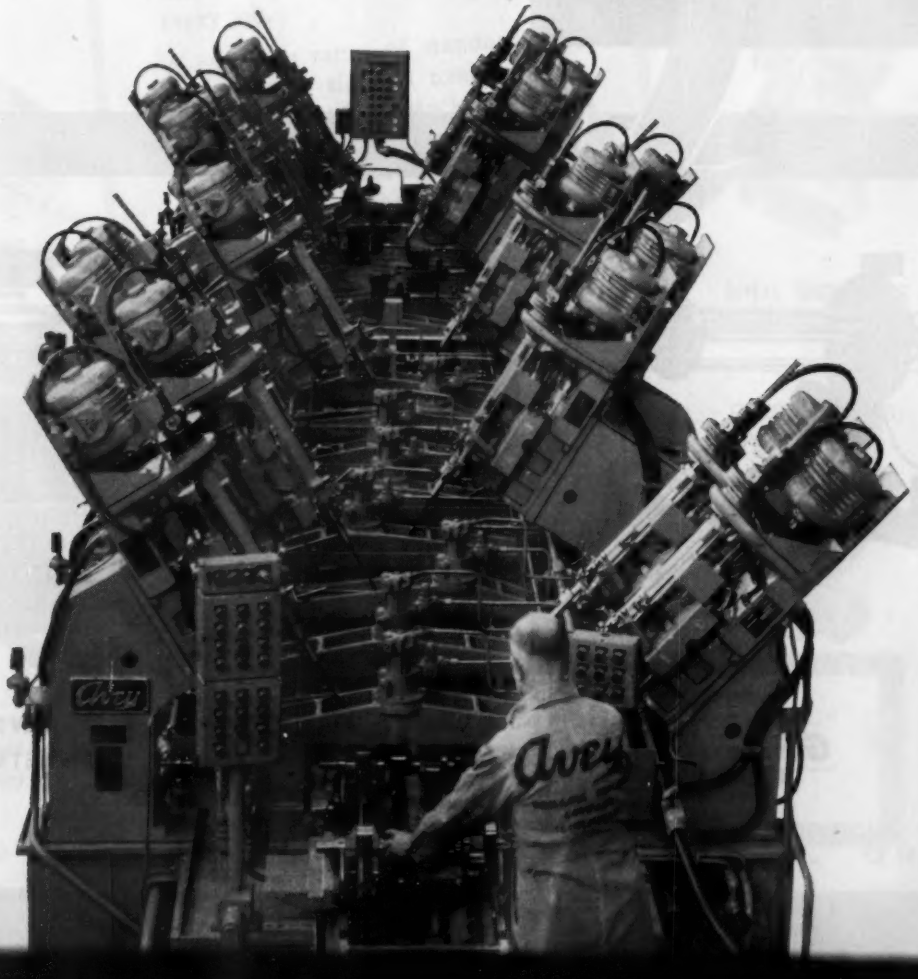
Avey machines earn their heads off because they make such surprising cuts in unit costs. Investment per sq. ft. of floor space is unusually modest. Then, when the order is done, you can generally re-engineer the Avey unit heads for another job at moderate cost, and start another profitable chapter in the history of your company. Send us a part print: ask for an Avey *profit prediction*.

THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

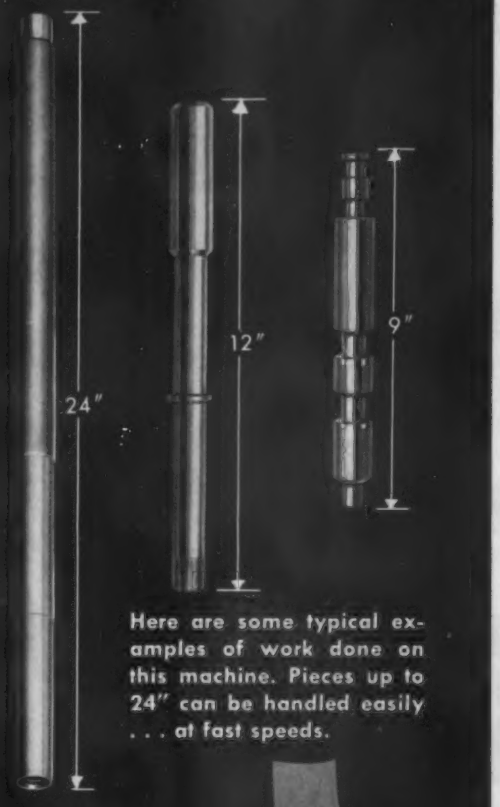
drilling, tapping, production machines

sudden obsolescence?

Avey



impossible to machine long parts AUTOMATICALLY on your present equipment?



Here are some typical examples of work done on this machine. Pieces up to 24″ can be handled easily . . . at fast speeds.

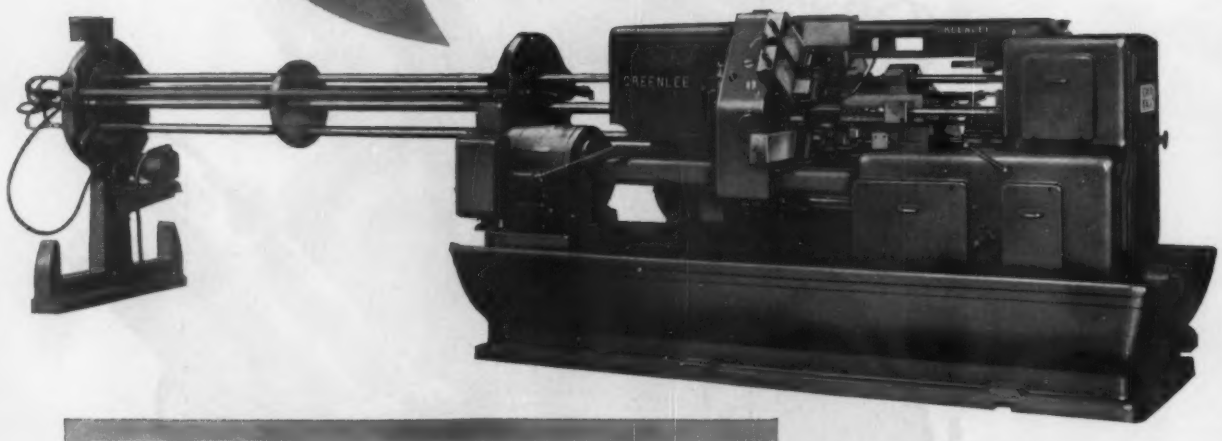
IT'S EASY...IT'S ECONOMICAL

with a GREENLEE SIX-SPINDLE BAR

AIR-FEED AUTOMATIC

This machine puts you in an enviable competitive position. Production goes up . . . costs go down. Check its many advantages: (1) Feeds out stock to 24″ (2) Has multiple feed-out (3) Eliminates stock scoring (4) Reduces stock reel noise (5) Eliminates stock pushers and feed-out cams. Especially worth noting is the fact that the stock can be fed out in one or more positions during either the index cycle or feed cycle.

Additional data will gladly be sent on request. Write today.



PRODUCTION MACHINERY
GREENLEE

GREENLEE BROS. & CO.
1730 Mason Ave.
Rockford, Illinois

WRITE FOR COMPLETE INFORMATION

SOLID CHUCKING REAMERS

EXPANSION REAMERS

each a specialist in cost cutting

Staples

CARBIDE-TIPPED CIRCULAR TOOLS

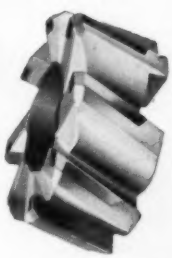
Your economy begins — and work quality improves—when you specify Staples carbide-tipped circular tools. They have established an enviable reputation throughout industry for delivering top-profit performance on every job.

A complete range of standard tool designs and sizes is available for quick delivery from stock. For your special tools, submit your specifications and prints for a prompt quotation. You'll be making the most of your standard and special tool investment when you put Staples Tools to work in your production.

SHELL-TYPE EXPANSION REAMERS

CORE DRILLS

STUB SCREW MACHINE REAMERS (SOLID AND EXPANSION TYPES)



SHELL END MILLS

END MILLS

COUNTERBORES, SPOTFACERS

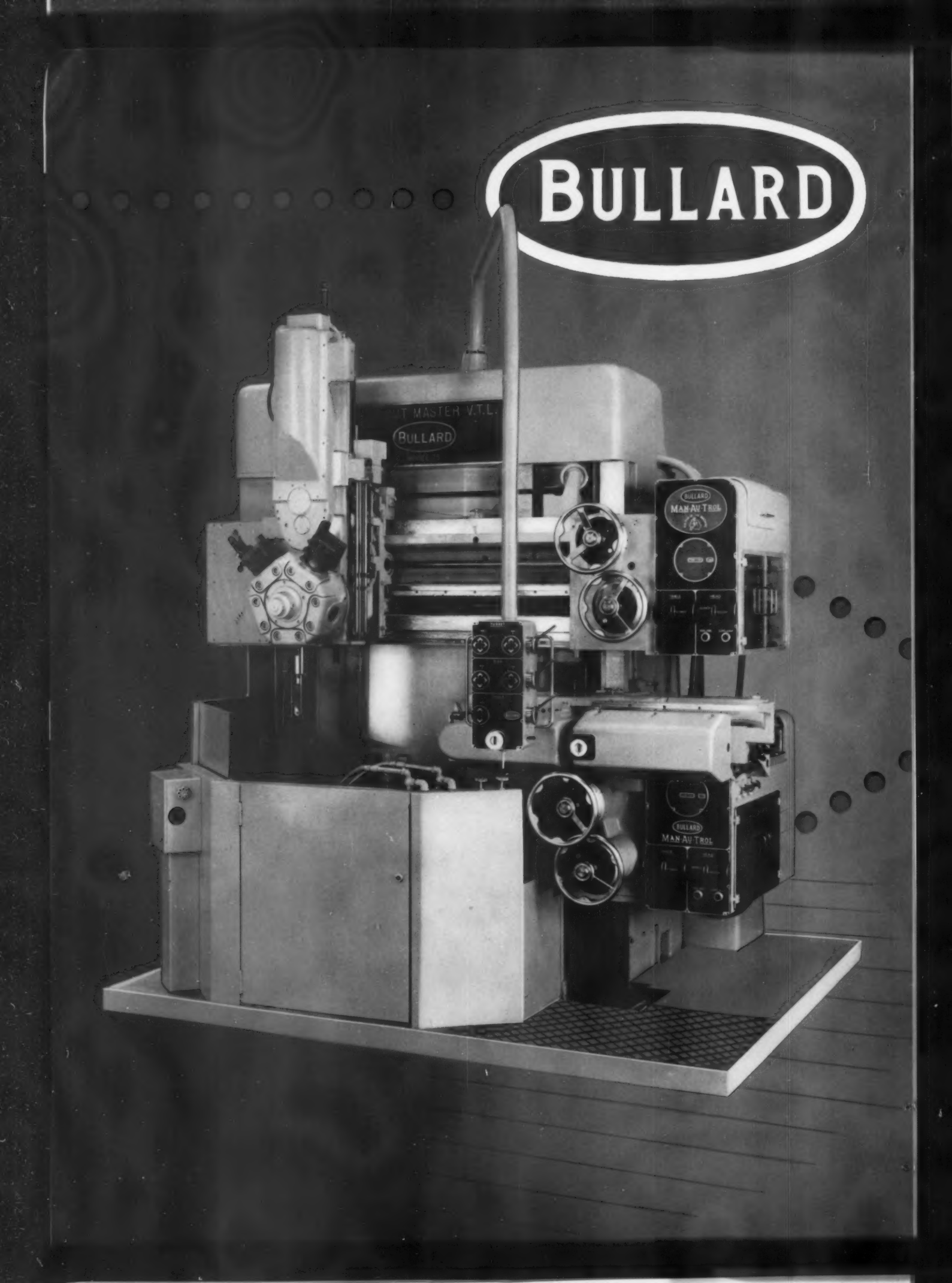
Staples

CARBIDE-TIPPED CUTTING TOOLS

A complete line of Circular Carbide-Tipped Tools, Expansion Reamers — Special Tools

Write for the Staples Standard Tool Catalog

THE STAPLES TOOL COMPANY, CINCINNATI 25, OHIO


BULLARD
T MASTER V.T.L.
BULLARD
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MAN-AU-TROL

don't BUY BULLARD
unless YOU WANT THE BEST!

Yes, Bullard Cut Master, Model 75 with Man-Au-Trol Conversion Unit is the best . . . most versatile automatic Vertical Turret Lathe offered to industry today . . . . .

All operating functions are automatically initiated and controlled by one function control drum and two detector drums in Man-Au-Trol: Table Speeds (20 Available), Feeds (16 Available), Head Travel in feed or traverse, right or left, up or down or 45° in any quadrant and Turret Indexing.

Since the function control drum can be pre-set for a given job in advance, the machine down time for job change-over is reduced to a minimum.

The Man-Au-Trol Conversion Unit can be applied to any or all heads of Cut Master, Model 75 right in your plant.

Your Bullard Sales Engineer will be glad to explain the many other advantages offered by Man-Au-Trol — your best buy in an automatic vertical turret lathe — call him or write for our new catalog.

THE BULLARD COMPANY
286 Canfield Avenue • Bridgeport 2, Connecticut

Please send me a copy of the
NEW MAN-AU-TROL MODEL 75 CATALOG

NAME_____

COMPANY_____ POSITION_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

This steel helps a hammer keep its head

It's an Estwing* solid steel unbreakable hammer. Made in one piece. Made of Youngstown high carbon manganese steel.

This steel must be strong and tough. It must possess the necessary qualities for forging, hardening and tempering. Because Youngstown has been furnishing it to accurate specifications for the last 14 years, Estwing's forging and heat treating operations have been fast and accurate.

Result: Costly rejections have been eliminated.
Employees find it easier to work.
Consumers get the world's only one-piece hammer.

By furnishing steel with the exact analysis, Youngstown has helped Estwing to effect substantial savings. Perhaps we can do the same for you. All it takes to find out is a phone call to any one of Youngstown's 28 district sales offices. Why not do it—today? It may save you a lot—tomorrow.

*Manufactured by Estwing Mfg. Co., Rockford, Ill.

Youngstown QUALITY STEEL

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices Youngstown, Ohio District Sales Offices in Principal Cities.

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - BLACK PLATE - RAILROAD TRACK SPIKES - MINE ROOF BOLTS

machines start
lubrication starts
savings start!

Call it automation—call it cybernetics—or call it just plain good business sense—no matter what name you tack onto it, it's saving thousands of dollars every year.

Example: A large machine tool plant in the East employed 42 full time lubrication men to service some 4,000 machines. These machines were highly complex gear cutters, milling machines, drill presses, machine tools capable of producing work to the closest tolerances. Lubrication was so complex that despite the greatest care some bearings were missed, some over-lubricated. Maintenance and replacement costs were high—too high.

Then an Alemite Lubrication Representative was called in. After a thorough study of the plant and the problems, he came up with a simple sound recommendation. Alemite Oil-Mist was installed on some of the machines—results were carefully observed. Then—savings were so impressive that a budgeting program was set up immediately to equip every major machine in the plant!

Now, the program is well under way and hundreds of machines are completely equipped with Alemite Oil-Mist, all paid for by savings. And, despite the fact that the plant has expanded and now runs 4,800 machine tools, the number of maintenance men assigned to lubrication has been reduced from 42 to only 16 because Oil-Mist lubrication is constant and automatic, starts when the machines start. Lubrication costs are way down, bearing life is extended, and production is up, thanks to Oil-Mist.

Here's the unit that brings these savings to any machine! This is the heart of the Alemite Oil-Mist system. It atomizes oil into tiny, airborne particles that are distributed to bearings through tubing. These form a continuous, uniform film of oil that lubricates and cools the bearing surfaces.

FREE—the complete story of Oil-Mist—how it can bring these savings to any machine in your plant. Specifications, typical installations, case histories.

Three types of fittings allow the use of Alemite Oil-Mist on any bearing—any machine!

1. Oil-Mist fittings bring the most efficient lubrication in the world to roller, ball, needle—or any anti-friction type of bearing.

2. Oil-Mist Spray fittings are recommended for open and enclosed gears and chains. Allows for concentrated application where needed.

3. Oil-Mist Condensing fittings are applied to plain bearings, slides, ways, vees, cams, and rollers. Completely condense Oil-Mist.

ALEMITE
REG. U. S. PAT. OFF.
A PRODUCT OF SW STEWART-WARNER
Ask Anyone in Industry

ALEMITE, Division of Stewart-Warner, Dept. C-105
1850 Diversey Parkway, Chicago 14, Illinois

Gentlemen: Please send me complete information on Alemite Oil-Mist. No obligation, of course.

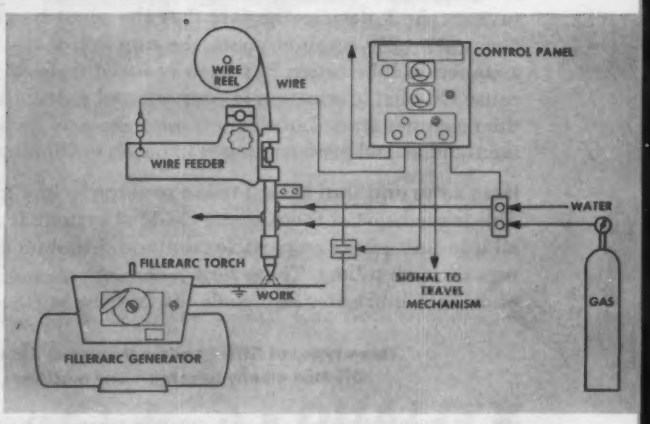
Name_____

Company_____

Address_____

City_____ Zone____ State_____

WELDING ARCS NEWS



G-E FILLERARC EQUIPMENT is the only complete equipment especially designed for consumable-electrode gas-shielded welding. Simplicity of the system makes possible use of less expensive fixtures and greater over-all efficiency.

NEW G-E Automatic Welding System Uses CO_2 to Slash Gas Costs 95%

FILLERARC . . . first *complete* equipment designed especially for automatic gas-shielded welding; combines unique generator with low-cost carbon dioxide—for sound welds on mild steel.

General Electric's new Fillerarc Automatic Welding Equipment brings you—not only 95% savings in shielding-gas costs—but *sound welds on mild steel.* The great savings possible through use of CO_2 as a shielding agent have long been recognized—but good mild steel weld quality has never been obtained. Now, after two years of successful application of Fillerarc equipment on non-ferrous metals (using inert gas), G-E engineers bring you the total solution for mild steel welding—*savings plus high quality.*

95% SAVINGS ARE POSSIBLE because CO_2 costs only *1/20th* as much as inert gas. For the average job, Argon would cost $5.00 per hour, CO_2 only twenty-five cents. This means yearly savings per equipment may be as high as $20,000 on a 3-shift, 60% duty cycle basis. This new G-E system can now replace the submerged arc method on many jobs and eliminate many of the problems associated with granular flux.

EXCLUSIVE G-E GENERATOR practically eliminates the erratic weld quality formerly obtained with CO_2. Here's why: Only the G-E Fillerarc generator—with its exclusive *rising* volt-ampere characteristic— supplies an arc length which always remains constant, even with adjustments in wire speeds. This means minimum weld porosity and spatter—and deep penetration for extra-strong welds.

COMPARED TO OTHER INERT-GAS SYSTEMS, G-E Fillerarc equipment . . .

- Reduces gas costs 95%, for yearly savings up to $20,000 per equipment;
- Delivers consistent weld quality because of the unique G-E Fillerarc generator;
- Assures constant speed; system is insensitive to normal line-voltage changes;
- Provides wire-feed speeds as high as 1000 I.P.M.

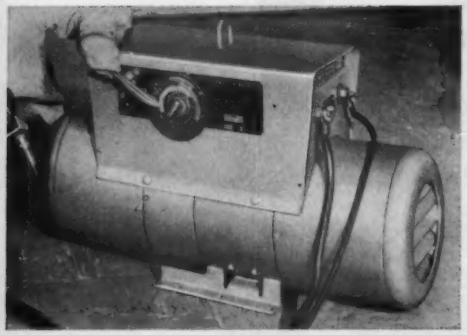
COMPARED TO FLUX-SHIELDED METHODS, G-E automatic Fillerarc equipment . . .

- Deepens penetration with low-cost CO_2;
- Provides a visible arc for full control of weld quality, permits less expensive fixtures;
- Does not use abrasive flux—especially important in welding compressor housings and similar jobs;
- Eliminates stubborn flux slag; cleaning costs are greatly reduced;
- Eliminates expensive flux recovery systems.

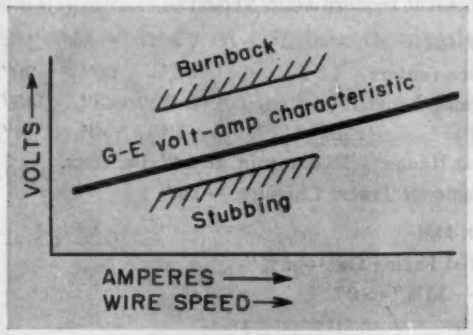
FOR MORE DATA contact your G-E welding sales engineer—and write for bulletin GEC-1334 to Section 713-1, General Electric Co., Schenectady, N. Y.

SEE G-E automatic Fillerarc equipment demonstrated at the National Metal Exposition, Philadelphia, October 17–21.

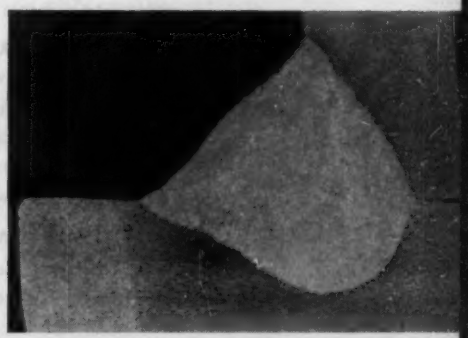
Why the complete G-E system makes possible quality mild-steel welds with CO_2



G-E SELF-REGULATING GENERATOR is the heart of the Fillerarc Automatic Welding system. Unique rising volt-amp curve maintains constant arc length.



RISING VOLT-AMP CURVE of the exclusive G-E Fillerarc generator matches rising arc curves . . . does not get into area of burnback and stubbing. Resulting high weld quality is uniform.



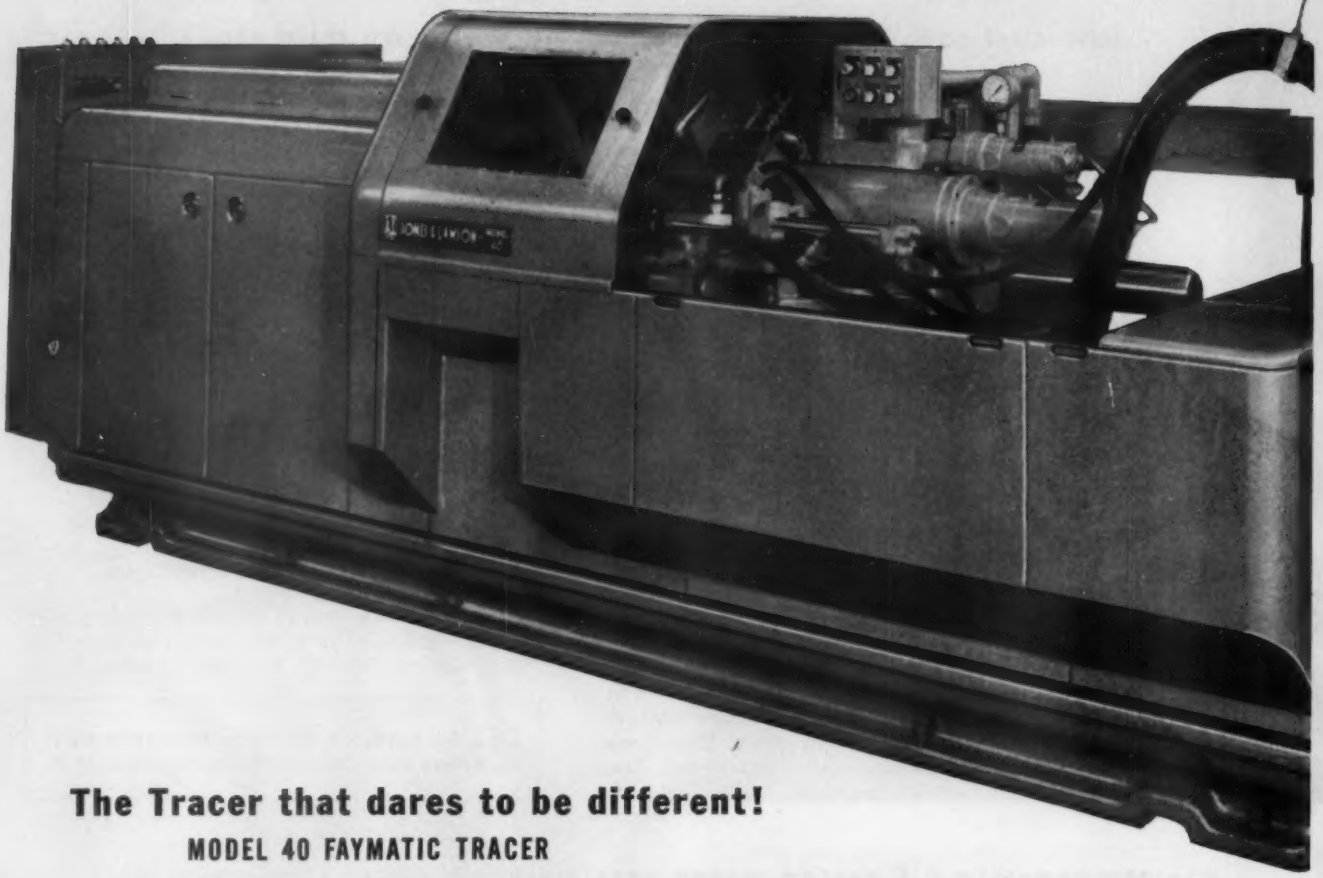
DEEP PENETRATION is produced by short arcs and faster wire speeds tpyical with Fillerarc equipment. Above: weld on semi-killed steel.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Here's what you have been asking for . . .

A HEAVY DUTY automatic sequential* TRACING LATHE . . .



The Tracer that dares to be different!

MODEL 40 FAYMATIC TRACER

REDUCES Tooling Costs — Set-Up Time — Handling . . . and is rugged enough to remove metal at modern High Velocities.

*Can also be operated manually

CAPACITIES FOR CARRIAGE

Distance between centers	36″	60″	96″
Maximum Turning Length	36″	48″	48″
Maximum Radial Facing Cut	4″	4″	4″

Tracing Turning Range — 1″ dia. min. to 14″ dia. max.

Maximum Swing over Tracer Carriage — 15″

CAPACITIES FOR BACK ARM

Maximum Radial Facing Cut — 3¾″

Facing Range — 13¾″ to 0″

J&L JONES & LAMSON MACHINE COMPANY

Jones & Lamson offers you a choice of methods for acquiring modern, profit-producing J & L equipment. In addition to outright purchase, J & L makes available several different "Pay-From-Productivity" plans at interest rates of 3¼ % and lower (add-on), and a broad variety of lease plans.

Send today for complete details on J & L's machines, methods and Procurement Plans. Simply fill in the coupon, clip it to your letterhead and mail.

a NEW CONCEPT of applying the tracer principle to a TURNING MACHINE!

- ✓ Handles ½" depth of cut on any of one to four automatically controlled tracing cuts.
- ✓ 12" back arm can be operated anytime during the carriage cycle for rough or finish facing cuts and for cutting grooves. Automatic tool relief on all finish cuts, both back arm and carriage.
- ✓ Two-position automatic indexing tool holder on tracing slide permits heavy roughing cuts with one tool and extremely accurate finishing cuts with another.
- ✓ Heavy Duty Headstock — 16 spindle speeds (through pick-off change gears) with automatic 2 to 1 or 2½ to 1 speed change under cut.
- ✓ Feed and speed changes occur automatically during a cut, insuring optimum cutting speeds on changing diameters and angles, as well as permitting roughing at one speed and finishing at another.
- ✓ Four hydraulic flow control valves and three control drums operating electrical limit switches comprise the entire set-up for a great variety of combination cuts, feeds and speeds.
- ✓ Hydraulic power is an enclosed compact unit — an integral part of the machine. Electrical controls are grouped in one enclosure.
- ✓ 40 H. P. Motor

MACHINE TOOL DIVISION

502 Clinton St., Dept. 710, Springfield, Vt., U. S. A

UNIVERSAL TURRET LATHES • FAY AUTOMATIC LATHES • AUTOMATIC DOUBLE-END MILLING & CENTERING MACHINES • AUTOMATIC THREAD & FORM GRINDERS • OPTICAL COMPARATORS AUTOMATIC OPENING THREADING DIES & CHASERS.

JONES & LAMSON MACHINE COMPANY
502 Clinton St., Dept. 710, Springfield, Vt.
U. S. A.

Please send me the J & L Machine Tool Replacement Information Kit.

*Name*_____

*Title*_____

Solve Your Inspection Problems with Taft-Peirce

No other air gage offers you the speed, range and versatility of a T-P CompAIRator. Look over these features and applications and see for yourself — then discuss your specific gaging problems with your Taft-Peirce sales engineer. He'll show you how to save time and money with Taft-Peirce CompAIRator Air Gages.

T-P COMPAIRATORS GIVE YOU THESE 5 ADVANTAGES

1. Instant Reading. No flutter . . . no creep . . . no appreciable time lag. Readings are virtually instantaneous even when extension hoses thirty feet long separate gaging member from CompAIRator.

2. More Versatile. No other air gage matches the accuracy over such a wide variety of applications . . . from simple diameters to simultaneous checks of such relationships as concentricity, squareness, and center distance.

3. Velocity-type Circuit. Venturi principle offers 3 advantages — accurate gaging of ID's as small as .055″ . . . magnification change simply by substituting one part and dial face . . . and linear readings.

4. Wider Tolerance Range. One basic CompAIRator with suitable gaging members and venturis, can check any specific tolerance range from .0001″ to .125″.

5. Gages Rough Surfaces. Contact type members allow precision gaging of parts with surface finishes beyond 50 micro-inches, rms . . . retain the self-positioning advantages of direct air gaging.

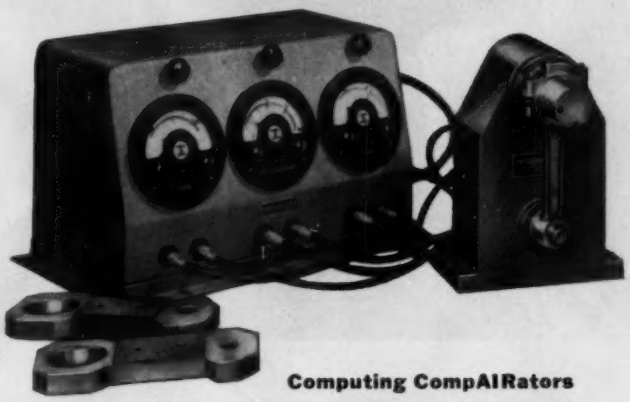
THE TAFT-PEIRCE

Problems by Air with CompAIRator Air Gages...

THERE'S A T-P COMPAIRATOR FOR EVERY INSPECTION NEED

CompAIRators

Available in single, double, or multi-dial units. Can be used with standard air plugs (for through-holes, counter-bores, or blind holes), air rings, and air snap gages — directly attached to cabinet, or to extension hose. Contact type members permit air gaging of rough surfaces. Special fixtures designed and built to order.

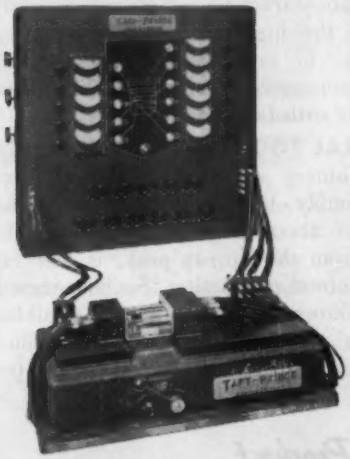


Computing CompAIRators

For measuring such relationships as squareness or center distance, a Computing CompAIRator eliminates making two separate measurements and a calculation. Does the whole job — measures, computes, and indicates the result instantly on a single dial. 3 dial unit above replaces 6 ordinary indicators.

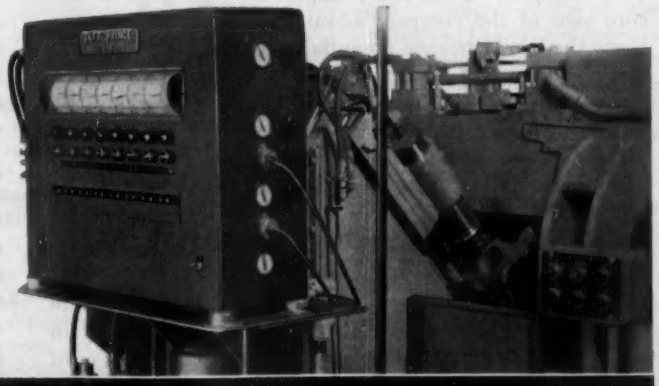
Air-Electric CompAIRators

For rapid inspection of a number of dimensions. Lights indicate any dimension out of tolerance. Exact reading can be then taken from proper dial face. Compact angular mounting of dials, either horizontally or vertically, speeds and simplifies reading.



Automatic CompAIRators

Easily incorporated into production lines where maximum speed of inspection is required. Automatically checks parts, rejects off-size work. Can be built directly into high production machine tools to actuate size control mechanism.



MANUFACTURING CO.

WOONSOCKET, RHODE ISLAND

T-P means Top Precision

HOW CAN THESE SKILLS OF SMALL BUSINESS HELP YOU?

JET ENGINE tail pipe is welded by Howard Sanders, foreman of General Tool's fabrication department. Typical of the initiative of many small businessmen, General Tool found a way to reduce costs in this fabrication work.

How skills developed on G-E defense subcontracts helped a small business expand production capacity

General Tool Company's steady growth, first stimulated by G-E orders for jet engine parts, offers opportunities for service to other manufacturers.

William Kramer and Harold Poe did a $1,500,000 business in Reading, Ohio, last year—50% more than their total for 1953. That's a healthy growth picture for their General Tool Company. Even more important, this growth is a sure sign of the company's value to the country, as it keeps the firm's defense potential high.

Why? Because General Tool grows bigger every year by using the skills and capacity it developed in handling G-E orders for jet engine parts. In adapting these skills to non-defense items, the company is prepared to work for other manufacturers, and, at the same time, preserves its role as a vital defense producer should the need ever arise.

BIG AND SMALL BUSINESS WORK TOGETHER. General Tool's story is an outstanding example of the results when big and small business help each other out. And Kramer and Poe were *very* small when they started in 1947. They had a bank loan, personal savings, and a corn field on the edge of town. They put up a 32′ x 70′ building, hired 6 men and went to work.

"Best break we got," partner Kramer volunteers, "was a G-E defense subcontract to make parts for jet engines. And because of the high-quality product demanded by General Electric," he says, "we hired expert personnel, bought better equipment—became a better company making finer products with faster deliveries."

TODAY, GENERAL TOOL'S PRODUCTION ranges from paper mill machinery to complex control devices for automobile assembly lines. The company's additional capacity, brought about in part by the stretch out of defense orders from the Korean peak, is fast being put to work on peacetime production. Such success in these times of change shows that when large and small businesses work with each other to produce for defense, they can also stimulate economic development in peacetime.

649-2

Progress Is Our Most Important Product

GENERAL ELECTRIC

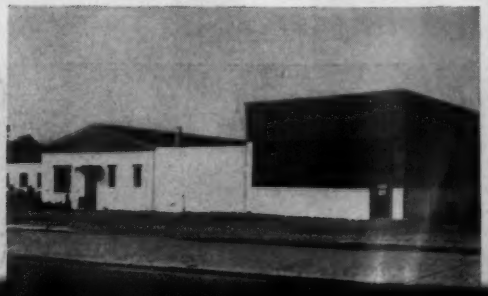
SMALL BUSINESS OWNERS, Harold S. Poe, left, and William J. Kramer, right, started as a partnership in 1947 with 6 employees. Now, as vice-president and president respectively, they employ 112.

MORE ACCURACY on all products resulted from G.E.'s rigid requirements. Here, R. Klausing, foreman, uses precision machine specially designed by General Tool designer working with G-E engineers.

EXPANSION of General Tool Company was rapid to handle G-E subcontracts. Engineers, above, hired to handle defense work, now design tools and machines for variety of non-defense uses.

IN CORNFIELD, on outskirts of Reading, partners started the business—used personal savings, plus a bank loan to buy property, erect a 32′ x 70′ building. Total sales in 1948 were $60,268.31.

TODAY'S PLANT covers 30,000 square feet of floor space, has 112 employees, did a $1,500,000 business in 1954 and continues ready for defense production if required.

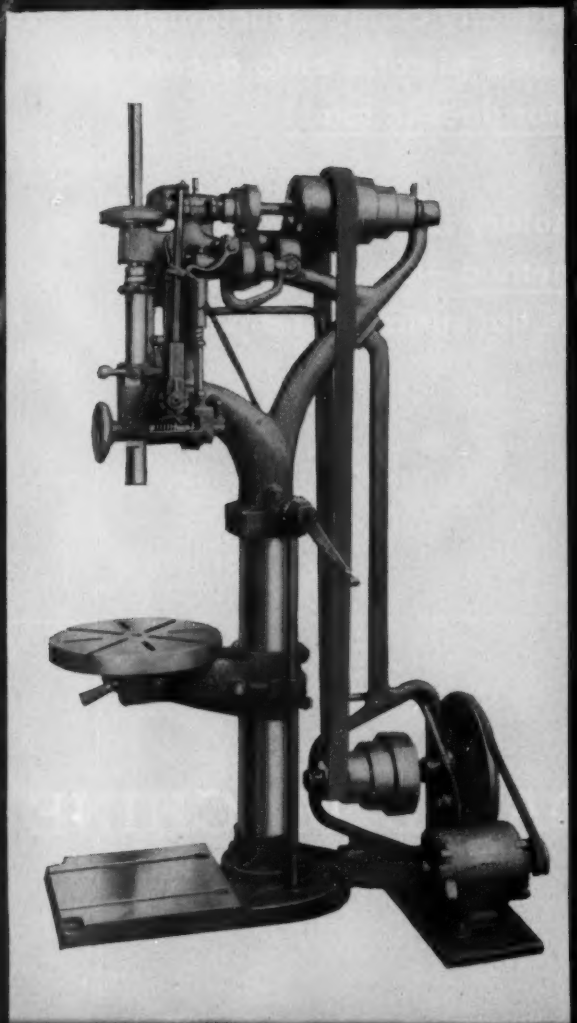


CAN SMALL BUSINESSES HELP YOU?

Thousands of small businesses, like General Tool Co., have furnished General Electric with practically every kind of skill and service as defense subcontractors and suppliers. Many of these companies have available production capacity, created in large part by the reduction of defense orders since the Korean War peak. This means that they may be able to apply their skills to help you with your production.

If you have a manufacturing problem or have work available for subcontracting, please write us on your letterhead stating in as much detail as possible the type of services or skills you require. We will be glad to suggest several small businesses who have done similar work for us and may be able to help you. Write to C. W. Bryant, Manufacturing Services Division, General Electric Co., 570 Lexington Ave., New York 22, New York.

Goodbye
"Old Faithful,"
we hate
to see
you go...



By rights, "Old Faithful", our 21" stationary head floor drill, should have been the first machine in our complete line to be redesigned. It looked old fashioned—even when new. But the funny thing is, we kept getting orders for it. Why? For the simple reason that it served a great need for general purpose and maintenance drilling. It was dependable. And it could drill holes like a demon, up to 1½" in cast iron.

In "Old Faithful's" place has come a brand spanking new Cincinnati 21" stationary head floor drill. It has all the ruggedness and dependability of its predecessor. That it's safer is easy to see, what with complete belt and gear guarding. But other changes have been made, too. Spindle travel has been increased a full three inches—to get at those deep jobs. Number of spindle feeds has been increased. The column diameter is bigger. Back gear change is accomplished now by a simple push-pull selector. Electrical controls are built in. *And every drill is shipped complete with motor and controls.* All you do is uncrate it—hook it up—start drilling.

We'll admit to a nostalgic twinge when we think of "Old Faithful". But the orders we're already getting for its successor eases our sorrow. Write today for catalog data and the name of your CL&T Dealer. Cincinnati Lathe and Tool Company, 3247 Disney Avenue, Cincinnati 9, Ohio.

CINCINNATI LATHES AND DRILLS

This is a fast

Every hour, this Newton Vertical Rotary roughs and finish mills the tops of 600 aluminum pistons at 85% efficiency.

The machine automatically clamps, unclamps and ejects the finished pistons onto a conveyor. All the operator does is load!

A Newton Vertical Rotary is more than a machine tool—it is a method—the fastest known method of milling the flat surfaces of repetitive pieces!

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED MACHINE TOOL

A DIVISION OF FARREL

For aluminum milling, Newton Vertical Rotaries have high speed Vee belt drives and feeds up to 100 inches per minute.

COMPANY, ROCHESTER 10, N. Y.

F/B

BIRMINGHAM CO., INC.

New High-Torque Unbrako self-locking socket set screws

set them, forget them—they stay tight

Up to 40% higher tightening torque—a new Unbrako feature

RECOMMENDED SOCKET SET SCREW TIGHTENING TORQUES
- (Inch-Pounds)

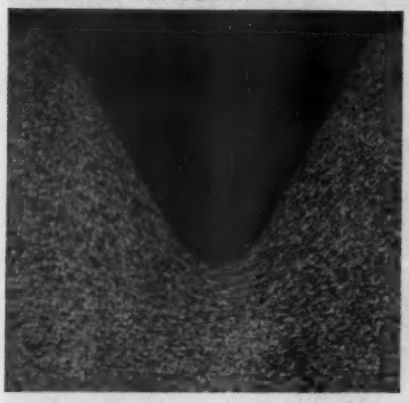
SCREW SIZE	UNBRAKO	SET SCREW B	SET SCREW C	MINIMUM DIFFERENTIAL %
#4	5	3.9	3.5	28
#5	9	7.8	7.4	15
#6	9	7.8	7.4	15
#8	20	14.7	14.5	36
#10	33	26.5	25	25
1/4	87	62	60	40
5/16	165	122	125	32
3/8	290	198	225	29
7/16	430	309	350	23
1/2	620	460	500	24
5/8	1225	1106	1060	11
3/4	2125	1540	1800	18
7/8	5000	3660	4600	9
1	7000	5025	6500	8

All UNBRAKOS can withstand higher tightening torques than ordinary set screws. For example, the recommended torque for a ¼" UNBRAKO is 87 inch-pounds —40% greater than that recommended for an ordinary set screw.

Research has proved that the tighter you seat a set screw the better it works. We went to work to design a socket set screw that could be tightened tighter than ever before without damaging the screw.

We formed a deeper socket. We put a radius in the socket corners. We developed fully formed threads. We established new methods of heat treatment in atmosphere-controlled furnaces. It took almost 6 years' research and development, but the new High-Torque UNBRAKO incorporates all of these improvements. And it retains the self-locking knurled cup point that keeps an UNBRAKO tight up to 48 times as long as a plain cup point set screw, regardless of the size of the point or the cup.

UNBRAKO SET SCREW

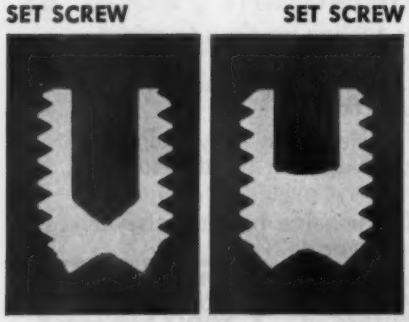


We fully form the threads—make the whole screw stronger. The metal is compressed into the closely knit grain structure that you see in this illustration. The grain flow follows the contour of the threads. There are no straight lines along which shear can occur. The UNBRAKO retains its flow lines even when ground down to .010" below root diameter. Screws with cut or ground threads lose thread form at root diameter.

UNBRAKO SET SCREW

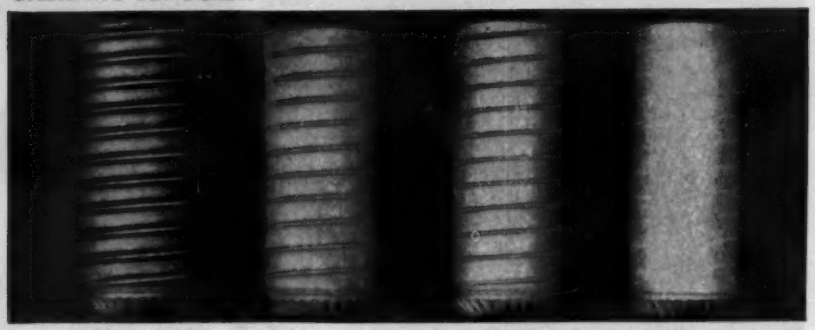
We put a radius in the socket corners—eliminate the sharp corners where cracks start. This distributes the stresses developed when tightening torques are applied. Ordinary socket screws have sharp corners which often crack when tightened even at lower recommended torques.

UNBRAKO SET SCREW **ORDINARY SET SCREW**



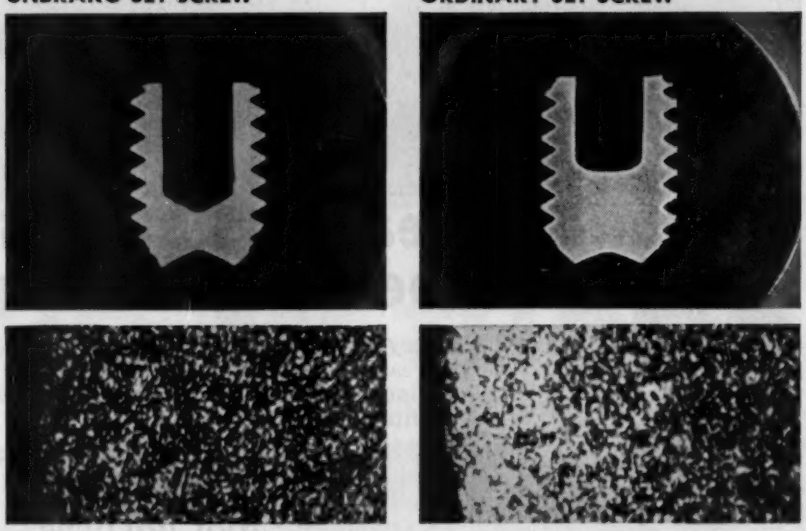
We form a deeper socket—give you more purchase with the wrench. Since more wrench can be put into the UNBRAKO socket, you can set the screw much tighter. And you won't ream the socket or round the corners of the wrench.

UNBRAKO SET SCREW



ORDINARY SET SCREW

UNBRAKO SET SCREW **ORDINARY SET SCREW**



We heat treat an UNBRAKO properly. It's a ticklish job to heat treat a socket set screw. If you don't do it just right, you get decarburization. And decarb plays havoc with a screw. Put a wrench in the socket and you ream it. Run the screw into a tapped hole and you strip its threads. Try to seat the screw and its point shears off. These photos show the good and the bad. The UNBRAKO is clean. Its grain structure is uniform. There is no decarburization—the ordinary screw is suffering from an overdose of it, socket walls, threads and point are full of the telltale white spots.

You can't buy another set screw as good as an UNBRAKO. See your authorized industrial distributor today. Or write STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.

STANDARD PRESSED STEEL CO.

UNBRAKO® SOCKET SCREW DIVISION sps JENKINTOWN PENNSYLVANIA

ARMSTRONG

The ARMSTRONG Threading Tool takes interchangeable high speed steel form-cutters which require only flat top grinding to resharpen—always hold their true thread form.

Write for catalog

Each year ARMSTRONG TOOL HOLDERS become more important to you

Every rise in labor costs, every added tax, every overhead burden, every increase in cutting steel prices, every new, more costly machine tool, all increase the importance of ARMSTRONG TOOL HOLDERS to profitable operation.

ARMSTRONG TOOL HOLDERS reduce direct tooling costs to an absolute minimum—"Save: All Forging, 70% Grinding, 90% High Speed Steel."

ARMSTRONG TOOL HOLDERS reduce tooling-up time to minutes, to the selection and adjustment of the holder and cutter.

ARMSTRONG TOOL HOLDERS permit increased speeds and feeds—produce more pieces per hour per machine tool.

ARMSTRONG TOOL HOLDERS are efficient for they embody a perfection gained by over 50 years of specialization in the development and refinement of tool holders.

ARMSTRONG TOOL HOLDERS are inexpensive because they are quantity produced by modern methods, for a world market... are used by over 96% of the machine shops and tool rooms... are carried in stock for your convenience by all industrial distributors of consequence.

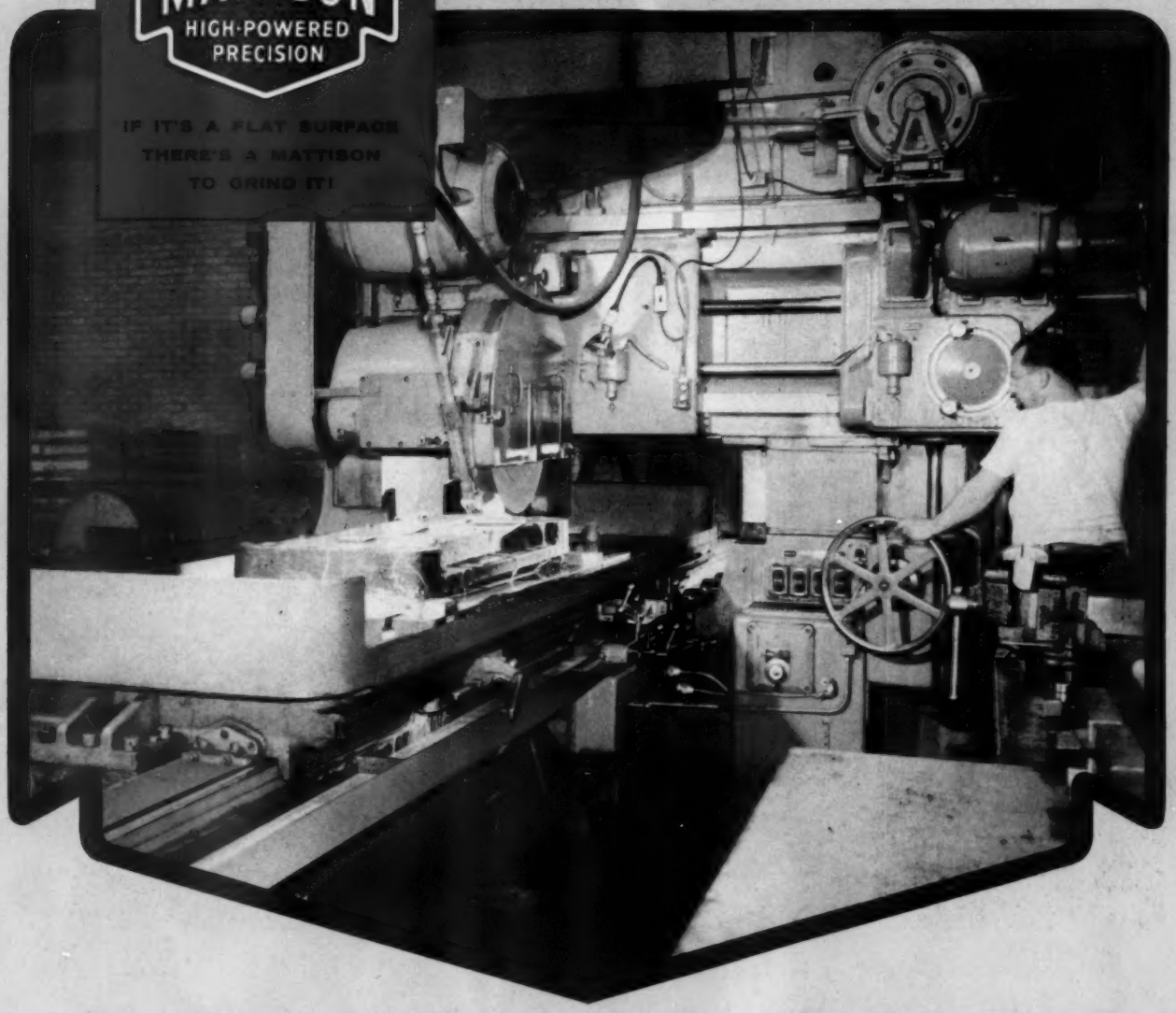
Buy ARMSTRONG TOOLS from your Industrial Distributor

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"
5215 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

MATTISON
HIGH-POWERED
PRECISION

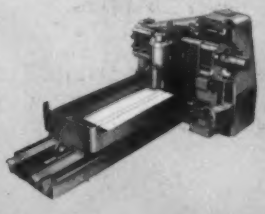
IF IT'S A FLAT SURFACE
THERE'S A MATTISON
TO GRIND IT!



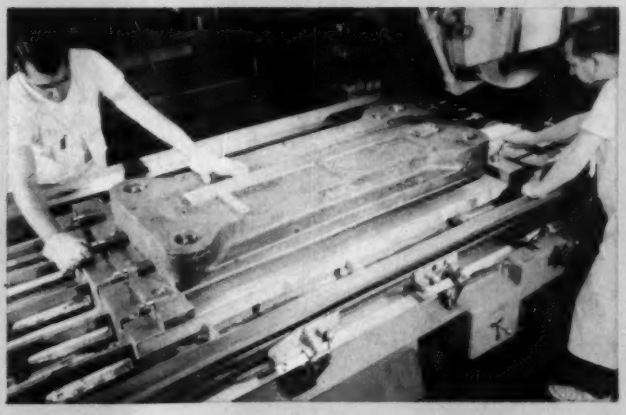
GRINDING METHODS

Accuracy upgraded from .006" to .0003", sharpening large blanking dies on the "Plano"

Improved precision, not increased production, was the primary goal of this user of a Mattison Plano Horizontal Spindle Surface Grinder. Yet, experience proved it possible to achieve both. One precision job ground on the machine is a male blanking die of high carbon, high chrome Ontario steel. Accuracy is maintained to .0003 in. compared to .006 in., which was the closest tolerance obtained on the previous equipment.



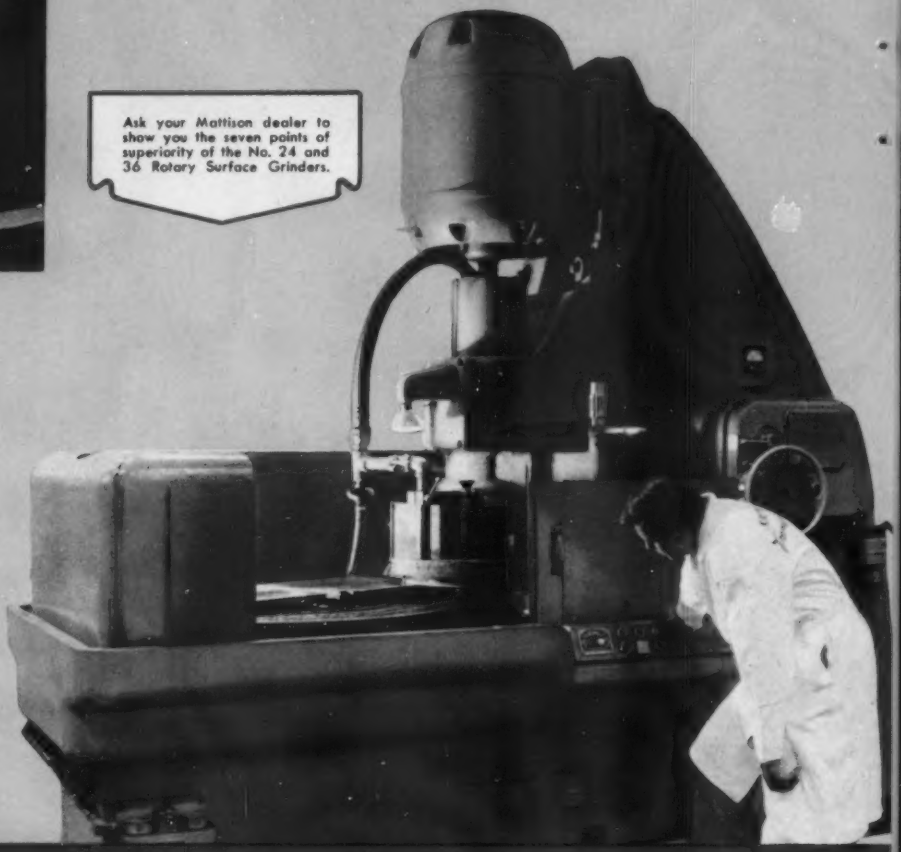
Floor-to-floor time for grinding the die has been reduced from 3 hours to 1½ hours on the Plano. Improved finish is another notable benefit gained.



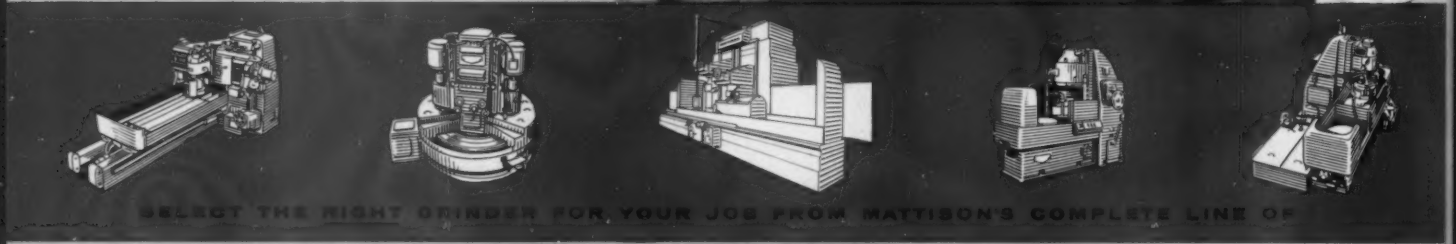
The Plano Grinder features massive, rugged construction and high horsepower characteristic of the entire Mattison line. It is unexcelled for grinding flat and "V" ways; long, narrow work; large, flat work; surface tables; plates; dies; jigs; and similar work. Write for Bulletin No. 345.

"High power" increases production 100% grinding hardened steel plates

Ask your Mattison dealer to show you the seven points of superiority of the No. 24 and 36 Rotary Surface Grinders.



Inaccuracy at any machining station in a transfer machine can cause trouble at every succeeding station—here's how Mattison's high horsepower, integral base and column assembly, and long, wide head slide ways prevent that trouble. One manufacturer uses a Mattison No. 36 Rotary Surface Grinder to grind subplates for a transfer machine built for an automobile maker. This plate, of 1019 steel and 50-60 Rockwell C hardness, is 19½ in. square with four milled pads on its base side. A light pass is made over the pads, after which the plate is reversed and the flat surface ground. Stock removal is .125 in., the plate must be flat within .002 in., and parallelism is held to within .001 in. The user reports that it would take 100 per cent longer to grind these subplates on a competitive make of grinder. Bulletin No. 146 describes the Mattison Rotary Surface Grinder line.

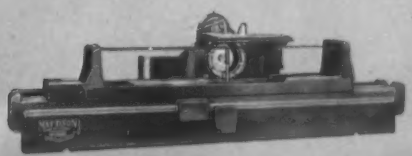


SELECT THE RIGHT GRINDER FOR YOUR JOB FROM MATTISON'S COMPLETE LINE OF

Face grinding surfaces of connecting rods accurately at high production rate

Precision grinding was an essential requirement in production of engine connecting rods at Caterpillar Tractor Co. Installation of a High-Horsepower Mattison Traveling-Table Face Grinder, with automatic feed, made possible accurate grinding of the matching surfaces at a high production rate. Rods and bearing caps are held in place by a hydraulically operated fixture.

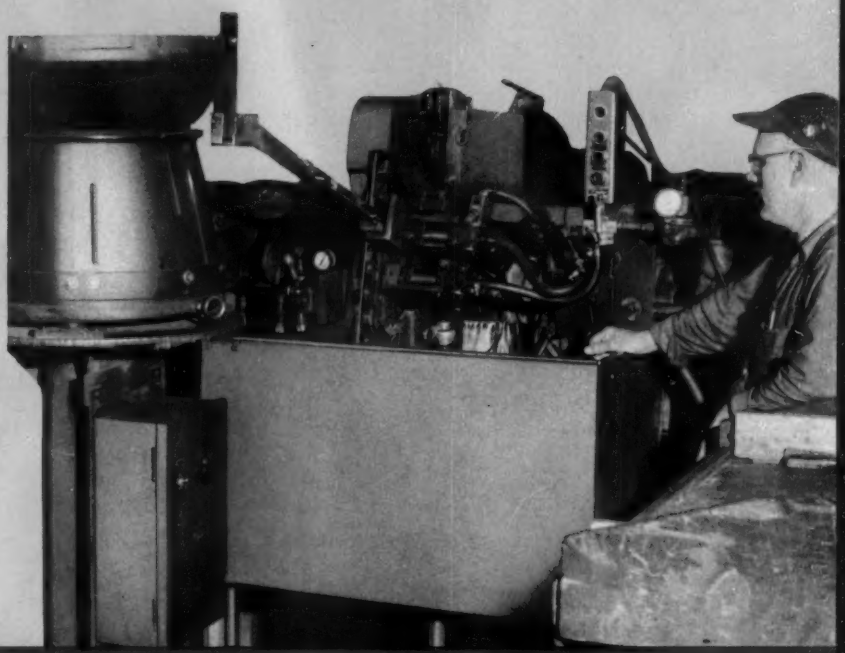
Mattison Face Grinders offer the advantages of high-horsepower and rigid construction for production, toolroom, and maintenance grinding. Bulletin 846-2RM describes the complete line.

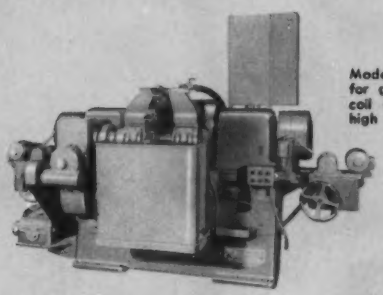


3200 Alnico magnets per hour on this fully automatic double-disc grinder

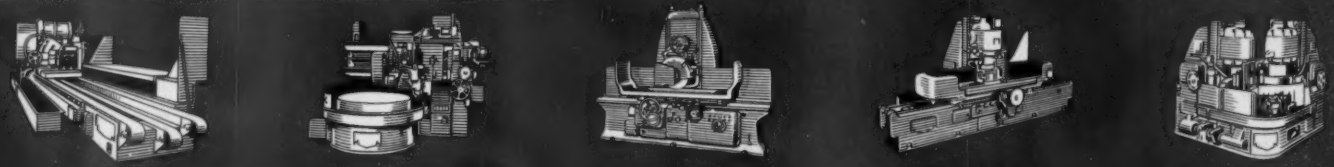
Production rate of Alnico magnets is 3200 per hour (both ends ground) on this Mattison Model 221 Double Spindle Disc Grinder, with one operator. Former method needed two operators and rate was only 500 per hour (both ends ground). Workpieces shown are .684 in. long by .460 in. diameter and extremely hard and brittle. Magnets are loaded into automatic feed hopper and stock removal is .024 in. to .030 in. on the over-all length. This dimension must be held to ± .001 in. with a 25 to 30 microinch finish.

Mattison Double Spindle Disc Grinders offer the best method of finishing opposite faces flat and parallel simultaneously. They provide high output per hour, combined with extreme accuracy and savings in time and cost. Six machines are available ranging from 10 in. to 30 in. disc wheel capacity—from 1½ to 50 hp. Automatic feed mechanisms of many types may be used, depending on production requirements.





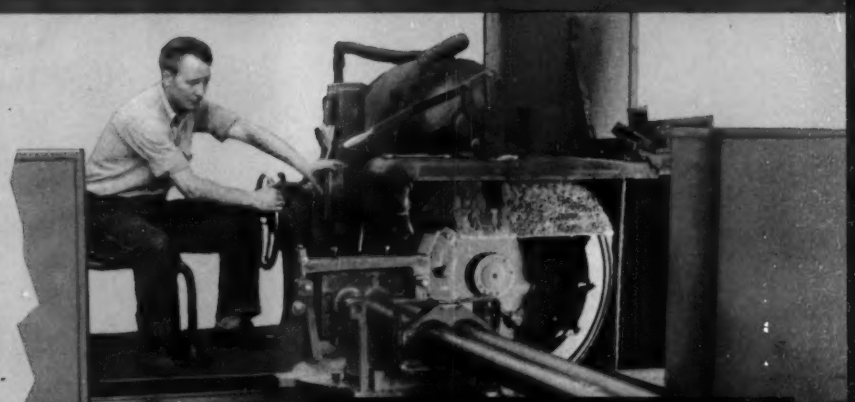
Model 221 is often used for grinding piston rings, coil springs, and similar high production jobs.

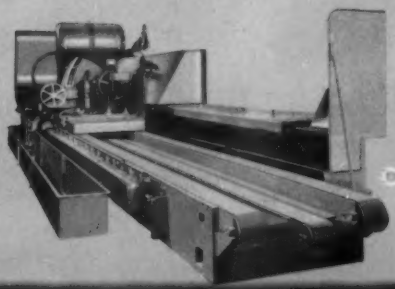


60 DIFFERENT MACHINES • SURFACE GRINDERS • FACE GRINDERS • DISC GRINDERS

$3500 saved yearly by grinding heat exchanger shell flanges

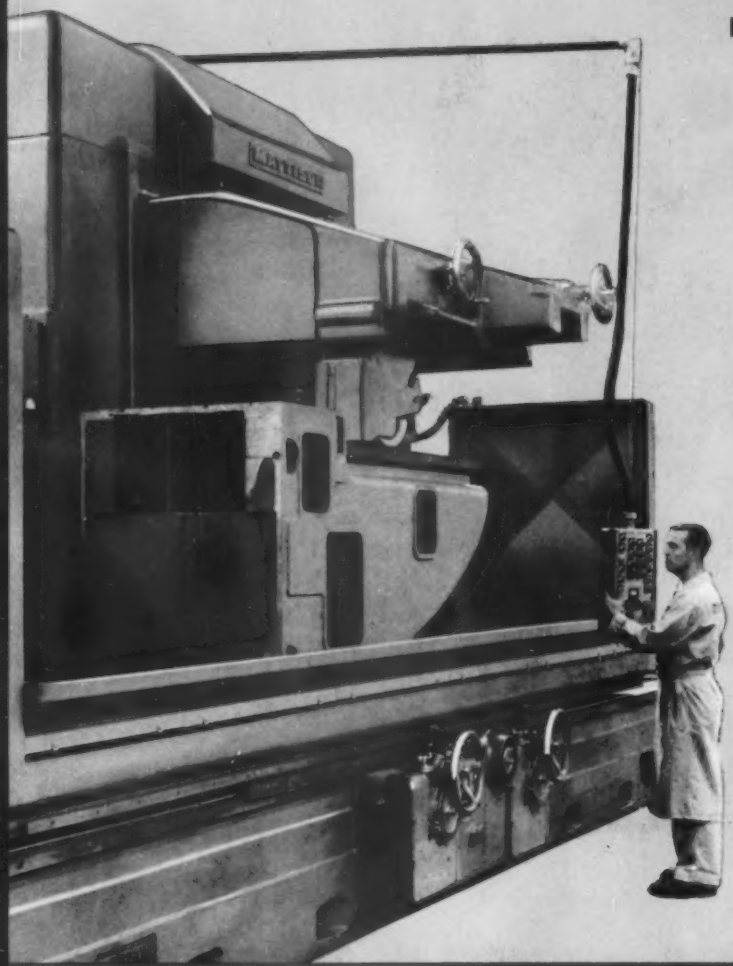
Grinding shell flanges and shell covers for heat exchangers on Mattison No. 500 Traveling Wheel Grinder saves approximately $3500 annually in stock removal for this user. To insure tight, leak-proof fit, surfaces of the shell flange (carbon steel) and shell cover (cast steel) are ground to 65 to 70 microinch finish with stock removal of .062 in. Flatness is held within .003 in. Send for Bulletin 844 describing Mattison Traveling Wheel Grinders.





Grinding long and bulky parts with speed and accuracy is simple job for traveling wheel grinder.

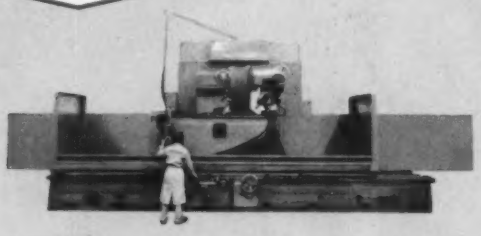
MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

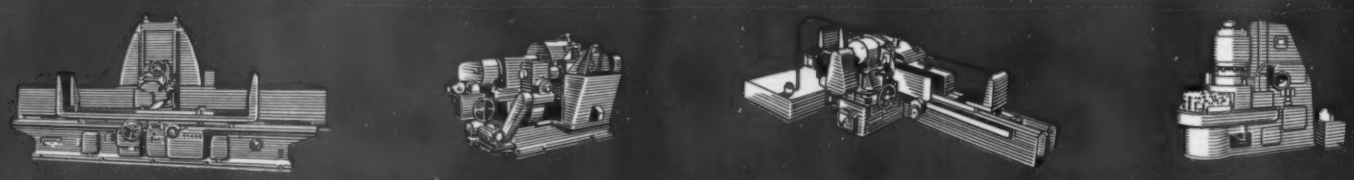


New "single-setup" method for grinding large machine tool castings

No time-consuming, costly rehandling of large machine tool castings when they are ground on the new Mattison Combination Way and Surface Grinder. Independent vertical and horizontal spindles allow grinding "V" and flat ways, dovetails, shoulders, radii, and contours in a single setup with maximum precision. Two or more surfaces can be held in exact relative alignment. Massive three-column construction permits heavy stock removal, with fine finish. Pendant control governs all operations of the machine, simplifying the operator's job.

Bed castings, columns, tables, slides, saddles, and heads can now be ground speedily with precision.





IF IT'S A FLAT SURFACE . . . THERE'S A MATTISON TO GRIND IT!

Send parts to Mattison Methods Laboratory for sample grind and production estimate

The Mattison Methods Laboratory . . . equipped with all major types of modern surface grinders, face grinders, and disc grinders . . . introduces a new service to metalworking plants. You are invited to submit parts for sample grinds, production estimates, wheel recommendations, and other production requirements. Please include part prints, operation or route sheets, and all special requirements for machining your piece-parts. You'll get a comprehensive report based on close duplication of field conditions. With a line of 50 different grinders for production and toolroom work, Mattison can specify machines that meet your needs *precisely* . . . and give you maximum accuracy, productivity, and economy.

MATTISON
MACHINE WORKS
ROCKFORD ILL U.S.A.

HIGH-POWERED PRECISION SURFACE GRINDERS

MATTISON MACHINE WORKS
ROCKFORD, ILLINOIS

one must set the example

. . . and with high speed steel it's REX

It's a real satisfaction when you set the example by what you make . . . when it becomes a *standard for comparison.* That's why Crucible is proud to have kept REX high speed steel tops in its class for so many years.

But don't take our word for REX's superiority. Try it on your own work. Compare its structure, finish, hardenability, carbide distribution and general uniformity. You'll see for yourself why it's the *standard* wherever high speed steels are used.

Remember, REX is made only by Crucible. So call for REX at your nearby Crucible warehouse, or for quick mill delivery — *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

TAPS *and* GAGES *by Card*

A select line of precision gages is now offered by Card, manufacturer of world-famous Card taps. In every industry, in every shop, these tools speed production, assure you of precision and satisfaction. The new line of gages is equal in every respect to the quality of manufacture that has made Card taps famous over the past 81 years.

Contact your local Card Distributor for prompt deliveries and helpful service.

The CARD Quality

S. W. CARD MANUFACTURING CO.

MANSFIELD · MASSACHUSETTS

Division of Union Twist Drill Co. · **TAPS · DIES · SCREW PLATES · GAGES**

A NEW PERSPECTIVE IN PRODUCTION

WITH LODGE & SHIPLEY *Powerturn* LATHES

It's time to take a new view of lathe economics. Whether the lathes in your plant are used for production or general purpose, you should be sure that they are producing as economically as possible. Lathes only a few years old may be liabilities from the standpoint of truly low cost production.

New Lodge & Shipley POWERTURN Lathes are designed in every way to facilitate turning to higher levels of profitable operation. Among many new features is the exclusive Computing Head which makes speed selection virtually automatic since the head indicates correct speed lever settings.

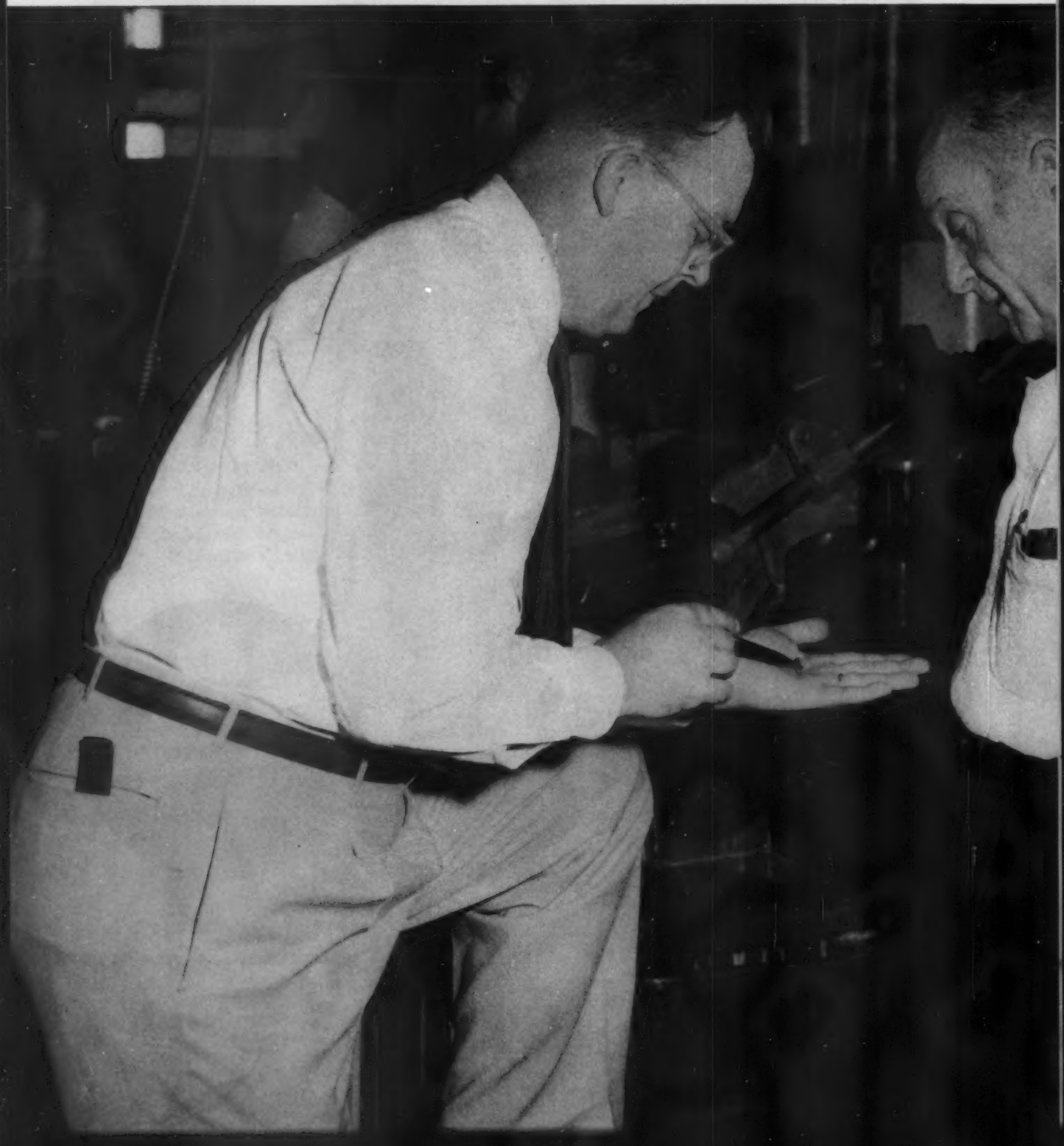
With all the new features, these Lathes offer traditional Lodge & Shipley rugged strength, power and accuracy. Get the facts now. "Up-date" lathe facilities for profitable production. Write for detailed literature: The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

16" POWERTURN Engine Lathe
(also manufactured in 13" and 20" Standard sizes, in Toolmaker, Gap, Manufacturing and 45° and 90° COPYMATIC models)

more than ever before . . .
your **LODGE-***ical choice is*

Lodge & Shipley

Bremen Bearings, Inc., uses SUPERLA



Soluble Oil to give bearings the clean, cool treatment

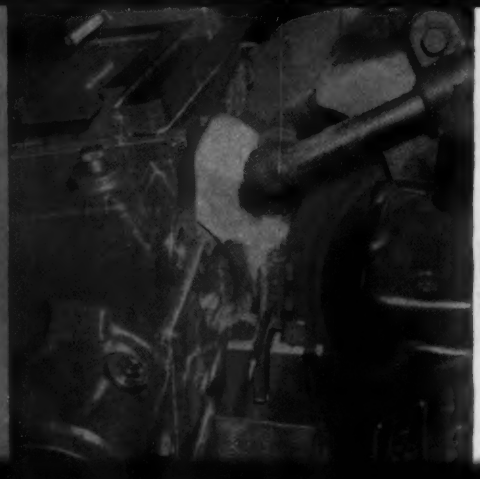
PRECISION NEEDLE BEARINGS are the exclusive product of Bremen Bearings, Inc., Bremen, Indiana. SUPERLA Soluble Oil is used exclusively in all eight of the Company's Cincinnati Centerless Grinders. Plant management experimented with various soluble oils before settling on SUPERLA. They found none could compare with SUPERLA Soluble Oil with respect to wheel loading, stability and tool machine cleanliness.

Plus these benefits, Bremen found SUPERLA mixed readily with water regardless of degree of hardness. The Company found, too, that they got longer tool life and maximum rust protection for work and machines.

You will have the same experience with SUPERLA Soluble Oil. Find out. Inquire of your Standard Oil lubrication specialist. In the Midwest call your nearby Standard Oil office. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Franklin D. Clark (right), Sales Manager, Bremen Bearings, Inc., and Standard Oil lubrication specialist E. A. Hunt, inspect needle bearing. Gene Hunt is well qualified to assist industrial plants on lubrication problems. In addition to his three years' experience in industrial lubrication sales work, Gene has an M. E. degree from Purdue and has completed the Standard Oil Sales Engineering School. Customers find this experience and training pay off *for them*.

Bearings being ejected from Cincinnati Centerless Grinder at Bremen Bearings, Inc. The Company manufactures needle and spindle bearings to customers' specifications in sizes from 1/16 to ½ inch with tolerances of .0001" and finishes to 3 micro-inches. SUPERLA Soluble Oil is used on all of Company's grinding machines.



STANDARD

STANDARD OIL COMPANY
(Indiana)

do your operators have this

Time Saver

to help cut machining costs on stub boring operations?

SET No. 11 ILLUSTRATED
WEIGHT 350 POUNDS

SUPER MICROMETER-ADJUSTABLE STUB BORING TOOL SETS

- 1¼ to 8″ Bore Range in 7 Tools
- Eliminate "cut and try" boring
- Precision adjustment to .0001″
- Reduce setup and tool changes

Your operators always have the right tooling answer at their fingertips—for cutting costs and improving accuracy on non-repetitive boring—when you provide them with Davis Stub Boring Tool Sets. Then time lost at the tool crib is ended. For without once leaving their machines, they can bore from 1¼ to 8 inches, pencil bore from ⅜ to 1¼ inches and do light, extended boring up to 13 inches.

Highest precision and fine finish are assured by Davis Super Micrometer-Adjustable mechanisms used in all seven basic tools in each set. It provides a wide range of cutter adjustments to limits of .0001″ by simply setting the micrometer screw's dial head at the desired reading. Exceptionally rugged construction makes Davis tool sets ideal for either rough or finish boring operations. Learn how this modern tooling idea can save money in your shop.

Write today for Davis Bulletin DB-50.

10 DIFFERENT STANDARD SETS AND MANY MODIFICATIONS READILY AVAILABLE

DAVIS

BORING TOOL DIVISION OF
Giddings & Lewis Machine Tool Co.
Fond du Lac, Wisconsin

WHY GROWL . . .

. . . **OVER YOUR GRINDING WHEEL PROBLEMS?** You'll solve them easily when you switch to CINCINNATI (PD) GRINDING WHEELS. Because *now* CINCINNATI Grinding Wheels offer POSITIVE DUPLICATION—the most talked about development in years. Positive Duplication is a remarkable achievement in precision manufacturing and quality control that can *save you money . . . and increase your production.*

Through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS are priced no higher than ordinary wheels.

Let us sink our teeth into your grinding wheel problems, and we'll have you purring like a kitten. Contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

Remember . . . *only* CINCINNATI Grinding Wheels give you . . . (PD) POSITIVE DUPLICATION.

CINCINNATI
Grinding Wheels
A Production-Proved Product of
THE CINCINNATI MILLING MACHINE CO.

"Our Records Show Needed by SKIL

96% Less Maintenance Disc Sanders"

says Mr. Kenneth Lindahl,
Superintendent, General Dairy Equipment
Minneapolis, Minnesota

"Lighter and easier to handle!" "Packs the power of much heavier units!" "Less trouble, fewer repairs!"

These actual statements by workmen and foremen show why the men of General Dairy Equipment choose SKIL Model 851 Disc Sander over any other.

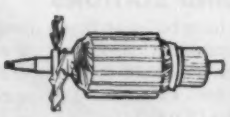
Finishing is an important part of production at General Dairy Equipment, world's largest manufacturer of aluminum butter churns. It takes a versatile, power-packed sander to handle the variety of jobs that need doing. But, more than anything, a more rugged, trouble free tool is needed.

Like many metal finishers, General has a tough maintenance problem because of aluminum dust. Wear, replacement, and downtime can be dangerous enemies of profit. That's why SKIL's 96% better maintenance record is so important to General Dairy Equipment.

As Mr. Lindahl says, "Stationary Equipment is out of the question for most of our operations. So we *must* have portable equipment that we can depend on. That's why we choose SKIL. We've compared SKIL with many others in our shop and our SKIL 851 rates first in every way. Not only with a 96% better service record, but from the standpoint of performance. The men like it, too, because it's lighter and more powerful. A good combination for less fatigue and more efficiency."

You'll Want These Finishing Advantages In Your Shop

- **QUICK CHANGEOVER** of accessories with convenient spindle lock permits easy switching from job to job including sanding, grinding, buffing, wire brushing.
- **FASTER WORKING!** 30% more power increases speed; gets maximum operating efficiency from every accessory.
- **EASIER HANDLING!** New compact design results in shorter length and lighter weight. Special rubber gear cushion makes for quieter, cooler running.
- **LOWER MAINTENANCE!** Large commutator inspection port permits frequent easy cleaning and checking. Sturdy construction throughout cuts repair need to a minimum.



IMPROVED MOTOR gives 30% more power!

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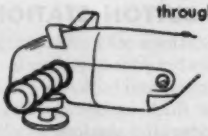

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REAR HANDLE contoured to fit the hand!

TRIGGER SWITCH for greater comfort in use!

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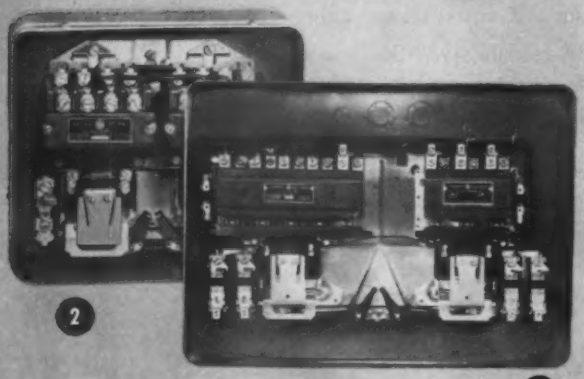
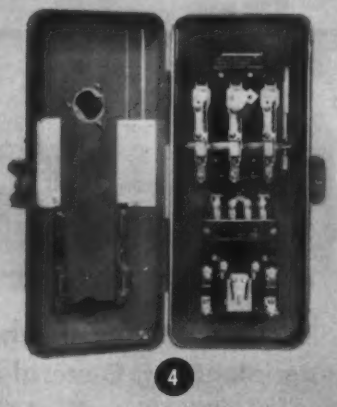




MAGNETIC CONTACTORS AND STARTERS

Select from a full line of open and enclosed devices—from fractional hp through 200 hp (600 volts, maximum). Available in every popular NEMA enclosure, including: general-purpose; semi-dust-tight; water-tight; dust-tight; explosion-proof; oil-immersed, corrosion-resistant; and JIC (automotive).

COMPLETE LINE OF MODIFICATIONS is offered on magnetic starters such as: push button or selector switch in cover, extra interlocks, third pole overload relays, separate a-c control circuit, and extra control relays.

1. **FULL-VOLTAGE MAGNETIC STARTERS** (CR7006) for squirrel-cage induction motors are available in size 0 to size 5 with bi-metallic overload protection.
2. **REVERSING CONTROLLER** (CR7009) combines two standard magnetic starters and mechanical interlock.
3. **MULTI-SPEED CONTROLLER** (CR7107) is ideal for full-voltage starting of 2-, 3-, or 4-speed squirrel-cage motors.
4. **COMBINATION STARTERS** (CR7008) provide disconnecting means and short-circuit protection by nonfusible or fusible disconnect, or circuit breaker.
5. **CONTACTORS AND MULTI-CIRCUIT CONTROL RELAYS** (CR2810 and CR2820) will handle loads from 5 to 240 amps.

PUSH BUTTONS, SELECTOR SWITCHES, INDICATING LIGHTS

STANDARD-DUTY PUSH-BUTTON STATIONS

(CR2943). Stations are available with 1, 2, or 3 buttons and in pendant form. Double-break silver contacts assure reliable operation. Units are back-mounted on cover and need not be removed for wiring.

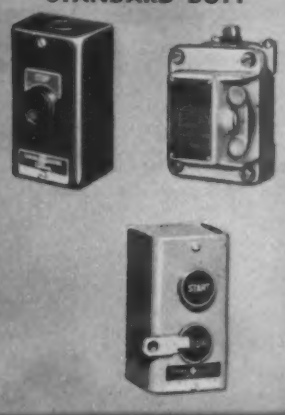
HEAVY-DUTY PUSH-BUTTON STATIONS

(CR2940). Stations offer wide variety of 1- to 6-unit combinations of push buttons, selector switches, and indicating lights. Also furnished for flush mounting. Palm-, foot- and treadle-operated stations available.

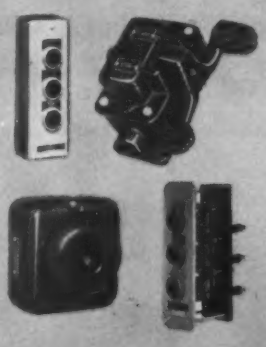
OIL-TIGHT PUSH-BUTTON UNITS AND STATIONS

(CR2940). Units have building-block design permitting any combination of contact arrangements. Also available are indicating lights and selector switches. Enclosures accommodate 1 to 16 units.

STANDARD DUTY



HEAVY DUTY



OIL-TIGHT

for all your general-purpose control

MANUAL AND REDUCED VOLTAGE STARTERS

1. **FRACTIONAL HORSEPOWER MANUAL STARTERS** (CR1061) are small-size, across-the-line starters operated by toggle switch—includes accurate bi-metallic overload protection.

2. **MANUAL STARTER UP TO 7½ HP** (CR1062) has snap-action toggle switch or push-button operator which trips free on overload. Available in 2-, 3-, or 4-pole forms.

3. **MANUAL REDUCED-VOLTAGE STARTERS** (CR1034) are autotransformer types used where reduced starting currents or limited starting torques are needed. Undervoltage protection prevents automatic restart in event of power failure.

4. **MAGNETIC REDUCED-VOLTAGE STARTERS** (CR7051, CR7056) are autotransformer or resistor types designed for remote or automatic reduced-voltage starting. Timing relay provides proper timing for step-starting, eliminating excessive motor inrush currents.

General-Purpose Relay. (CR2790). For control circuit applications. Small in size with extremely long life. Rated 10 amps continuous (left).

Solenoids (CR9500). New strongbox solenoid provides firmly anchored terminal and lead-type connections in a single unit. 22% smaller units mount five different ways. Complete rating coverage in push and pull, 24 to 600 volts, 25 to 60 cycles and d-c (right).

Plugging Switch (CR2962). A pilot circuit device used in conjunction with reversing magnetic starter to automatically apply and remove plugging power for quick stopping of a motor.

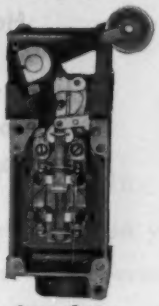
Pressure Switches (CR2927). A pilot device used to handle small motors directly or in conjunction with a magnetic starter for starting and stopping pressure generating equipment.

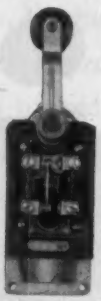
Float Switches (CR2931). Used in conjunction with a magnetic starter to start and stop small a-c and d-c motors. Float and counterweight may be interchanged for tank or sump operation.

LIMIT SWITCHES

LEVER OR ROTATING TYPE

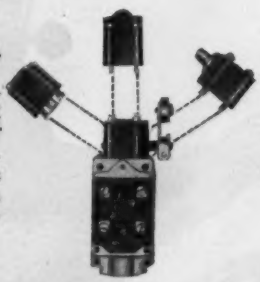
Double Circuit Lever Type (CR9440D). Snap action contacts can be changed from normally open to normally closed or vice versa. In open or oil-proof enclosed forms.

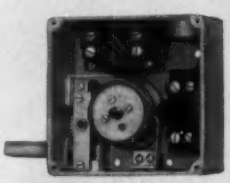




Snap-Action Lever Type (CR9440J). Used for heavy make-and-break requirements. Forms are available adjustable through 360 degrees. Operating lever firmly attached to shaft by double set of splines.

Small Snap-Action Oil-Tight (CR9440K). Only 1¼ and 1½ by 4½ inches. Oil-proof switch has 4 interchangeable heads that can face in any of four directions.





Rotating Cam Type (CR9441E) Two snap-action contact units operated through a worm gear reduction. Operating cams are easily set by adjusting only two screws.

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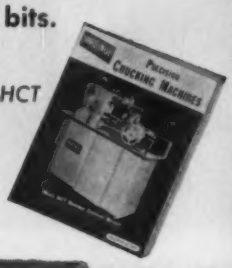
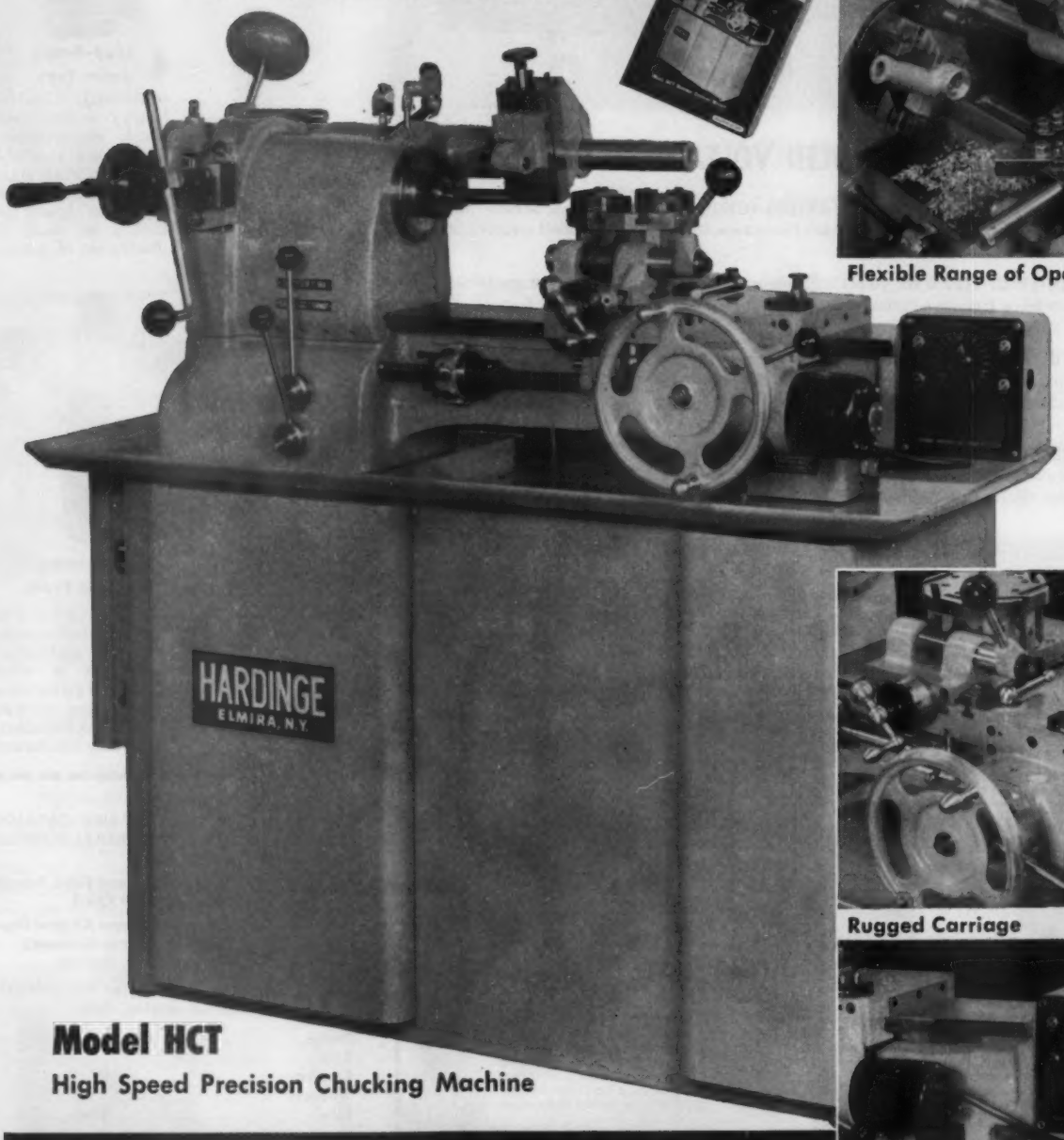
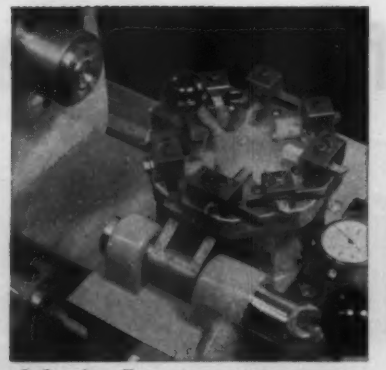
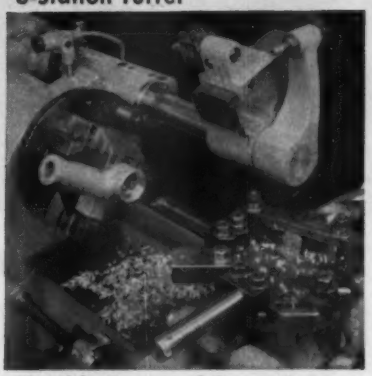
For complete information write for Bulletin HCT

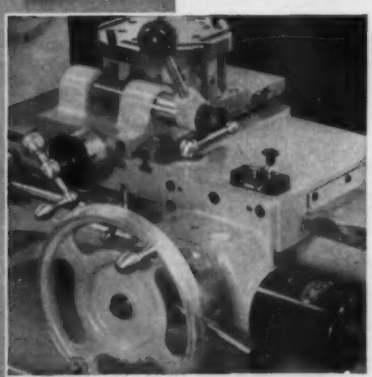


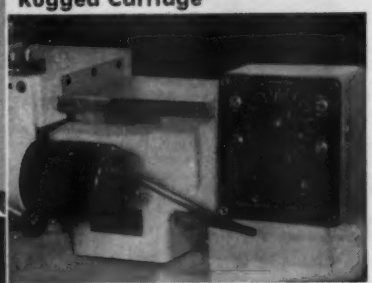


Model HCT
High Speed Precision Chucking Machine


8-Station Turret


Flexible Range of Operation


Rugged Carriage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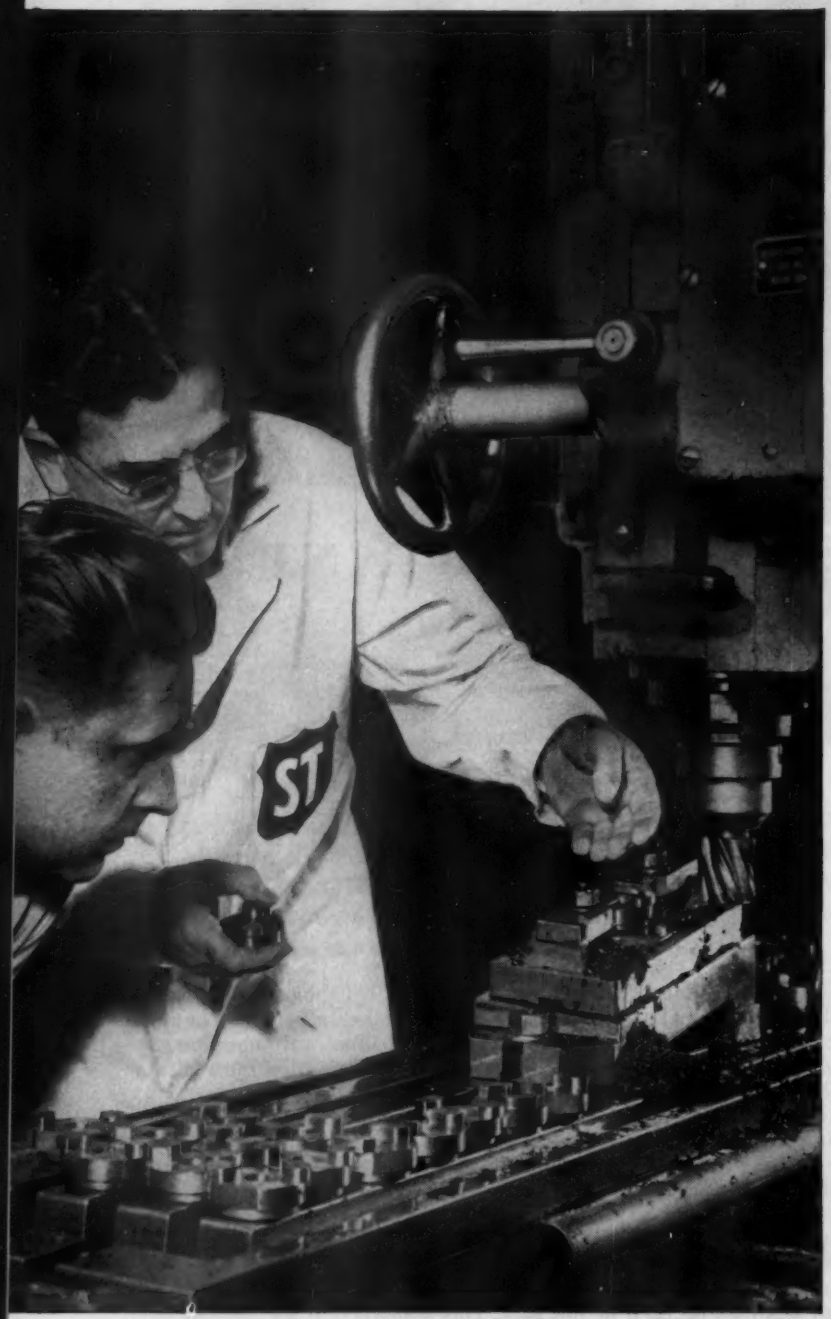

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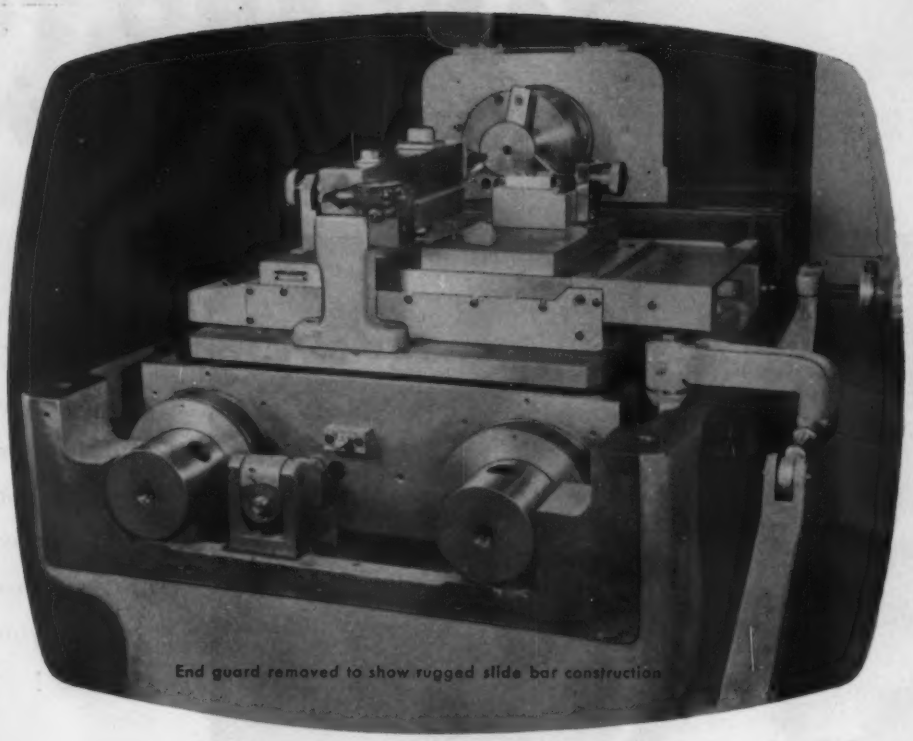
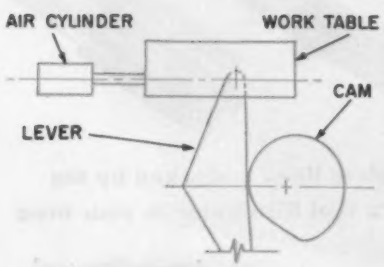

End guard removed to show rugged slide bar construction

...on the BRYANT 998 precision boring machine!

Part—Gear blank, 1045 steel, 18 to 20 Rockwell "C"
Operation—Bore .4955 +.0005, $1\frac{3}{16}$" long
Turn 3.000 −.002, ⅛" long
Finish face
Stock removal—.007 to .010
Cutting speed—1250 R.P.M., 800 S.F.M.
Feed—5 I.P.M. on diameters, $3\frac{1}{4}$" to $7\frac{3}{4}$" on face
Lead—.004 on diameters, .003 to .007 on face
Finish required—40 to 60 micro-inches
Production—74 pieces per hour at 100%

Tooled to do five different gear blanks, the Bryant 998 shown above, bores, turns, and faces short run lots economically and with highest repetitive accuracy.

A wide range of operations—precision boring, drilling, turning, facing—plus contour turning and boring can be done at peak production rates on the Bryant 998.



The Bryant 998 is designed to allow rapid interchange of fixtures and tooling for machining a wide variety of parts. Its table is actuated mechanically by a precision cam and lever unit—providing positive control of the cycle at all times. This feature also eliminates variation due to temperature change of a hydraulic system.

The table's smooth, uniform motion assures fine finishes. The table moves on two 4"-diameter solid steel slide bars firmly bolted to the bed and is supported by two anti-friction pre-loaded ball bearings on each of the bars. This construction provides a metal-to-metal contact which eliminates shifting due to oil film. *Write for Bryant 998 Job Folder.*

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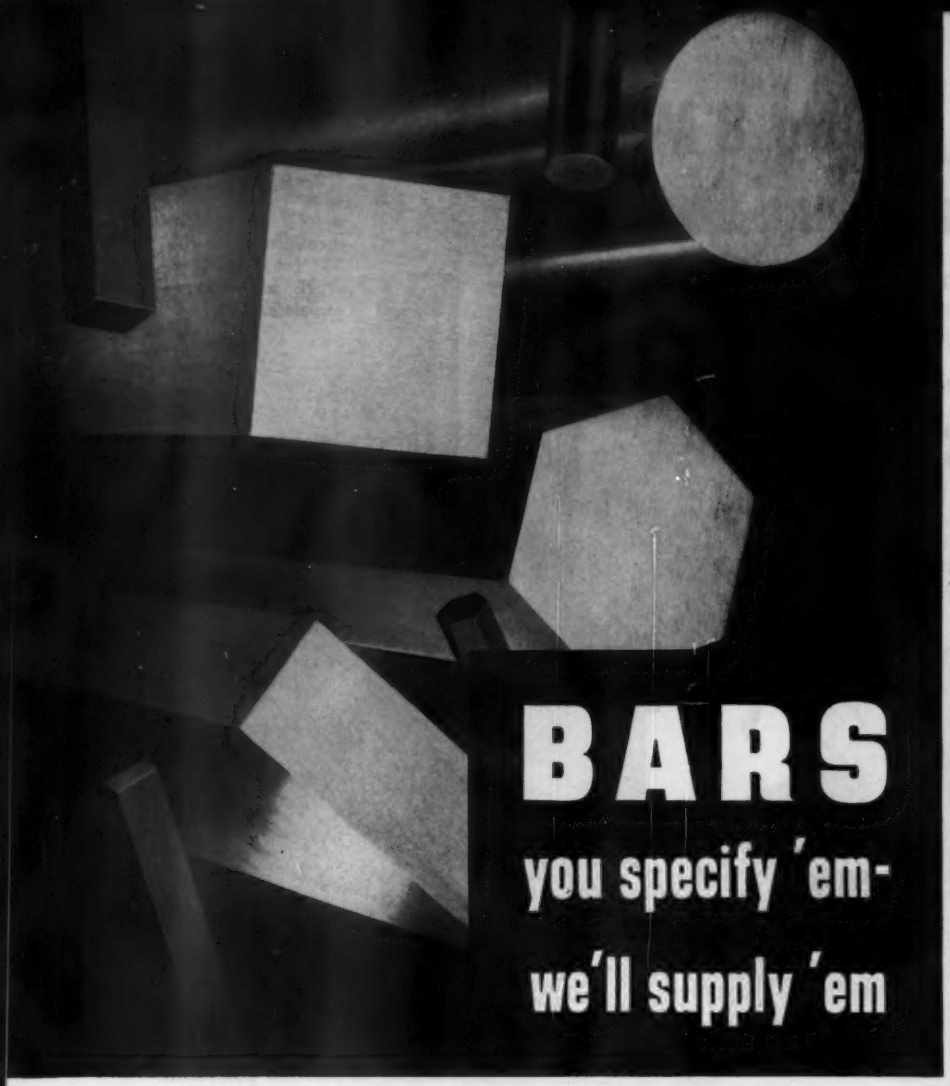

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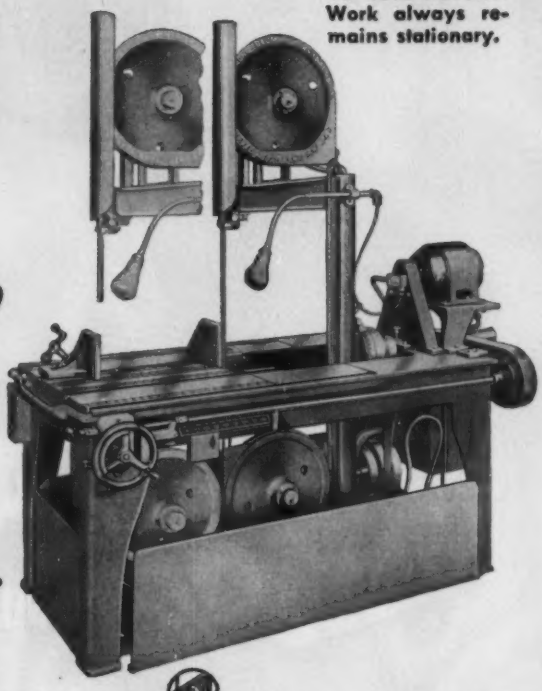
Never Confuse the No. 8 MARVEL with an ordinary Band Saw

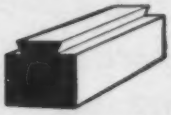
...only the MARVEL is Universal

Only on a MARVEL No. 8 does the blade remain at a right angle throughout its full 18" feed traverse. Work always remains stationary.



Only on a No. 8 MARVEL can the saw column be instantly indexed and locked at any angle from 45° right to 45° left, and the saw then fed thru the work at the desired angle — without moving the work.

Only a No. 8 MARVEL can do all of these things: Snip-off a ⅛" rod or cut-off an 18" x 18" cross section



Rough to Size and Shape

Miter

Index

cut off and shape Structural Beams.

Only a No. 8 MARVEL has the large T-slotted work table, with removable quick action vise, that permits accurate set-ups of work of unrestricted sizes and shapes, special fixtures; Etc.

"Rough Machine" to size and shape with minimun chip waste

The No. 8 MARVEL is the "busiest tool in the shop" wherever installed because it is a *universal* tool—has both the capacity and the versatility to handle not only standard sawing jobs but innumerable "trick" and convenience jobs as well. More than a metal saw, the No. 8 MARVEL is a fine machine tool with machine tool features like: Both power and hand feeds; Depth Stops; Automatic Blade Tension; Built-in Coolant Pump; Three operating speeds (or six with 2-speed motor). Moisture-proof electrical controls that conform to both "J.I.C." and "MACHINE TOOL" electrical standards; Dirt-proof ball bearings, etc.

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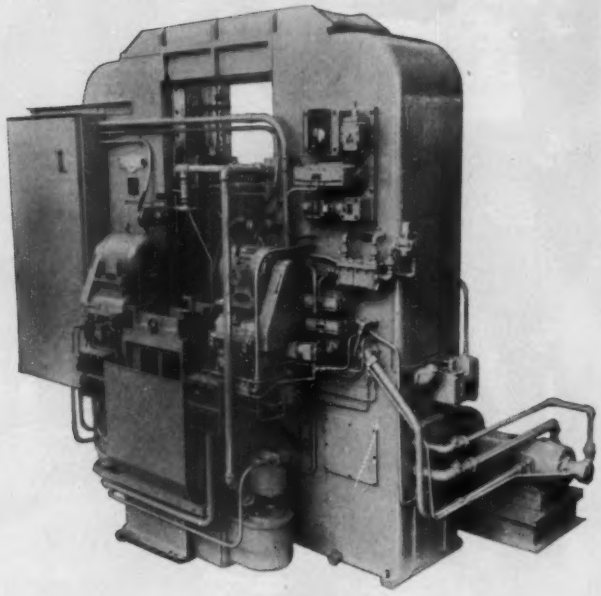
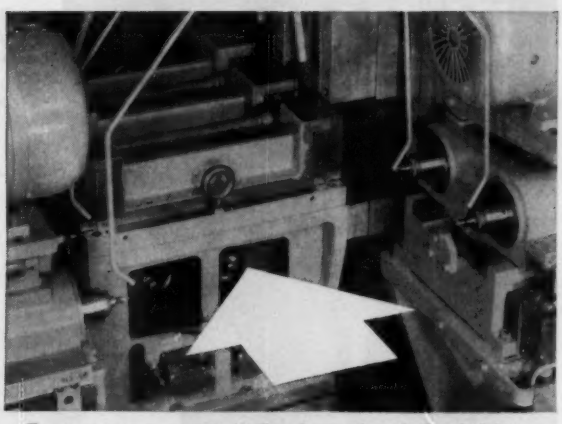
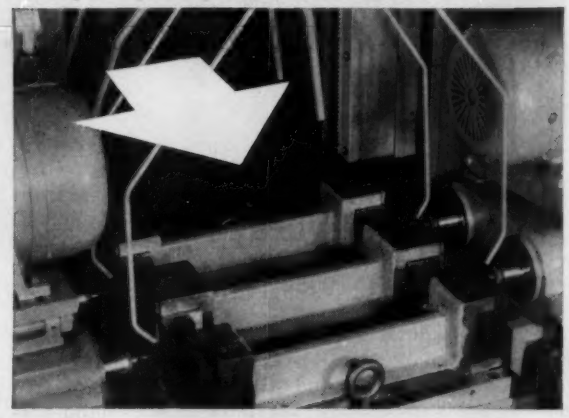




Two parts are automatically clamped and shuttled into broaching position by hydraulic slide. Surface broach sections mounted on the two rams move down to broach approximately ¼" of stock from each end of forged parts.

While the rams return, the slide moves back, positioning parts for center drilling of both ends. Drills move in, after which parts are automatically unclamped. Complete cycle is push button controlled.



Here, in one machine, American has combined two operations — broaching and center drilling of both ends of automotive main transmission shaft forgings, two at a time.

Two standard vertical hydraulic broaching machines were adapted to a common center table that is equipped with a hydraulically operated slide and two-station clamping fixture. Parts are automatically clamped in place, shuttled into the broaching and drilling positions, and unclamped — with the entire cycle being interlocked with electrical controls.

American engineers will be happy to recommend the broaching equipment either special or standard, that is best for your operation. Send sample part or detailed drawing. Your requirements will get prompt attention.

Write for Catalog No. 450, American's revised informative manual of broaching machines, broaches and fixtures.

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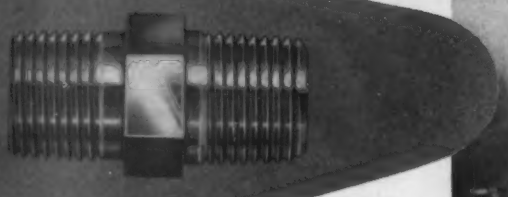
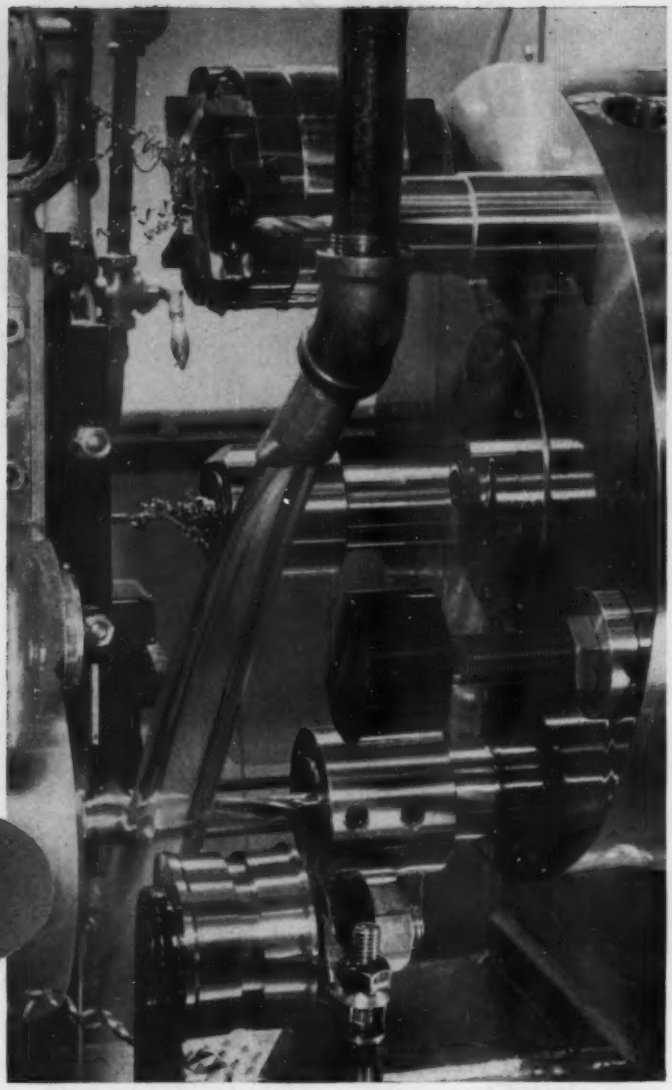
PRODUCTION TRIPLED!



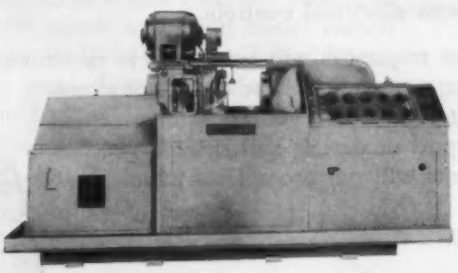


▲ Showing Cleveland Dialmatic tooling used to produce the above part. Operation sequence: *Gauge; Drill* ⅜" hole; *Form* thread diameters from front slide; *Chase* ½-14 thread from turret; *Drill* ¼" hole; *Roll* ½-14 thread from rear slide; *Ream* ⅜" hole; *Cut-off.*

The valve body shown above actual size, made from ⅞" Hex. Type 316 *Stainless Steel,* is one of some 40 different valve and pump parts the Milton Roy Company, Philadelphia, produces on their new Cleveland Dialmatic 3" Single Spindle Automatic.

As an example of the economies the new Cleveland effects, the above part was formerly produced in one machine and in two operations, at a rate of five pieces per hour. Now, the part is Cleveland-machined complete in one cycle (see operation sequence at right) at the rate of 15 pieces per hour, *tripling production.*

It will pay *you* also to investigate the many cost-cutting advantages of Cleveland Dialmatics.



CLEVELAND 3" MODEL AB DIALMATIC
Also made in 1⅜", 1⅝", 2½", 4¼", and 5¾" capacities.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

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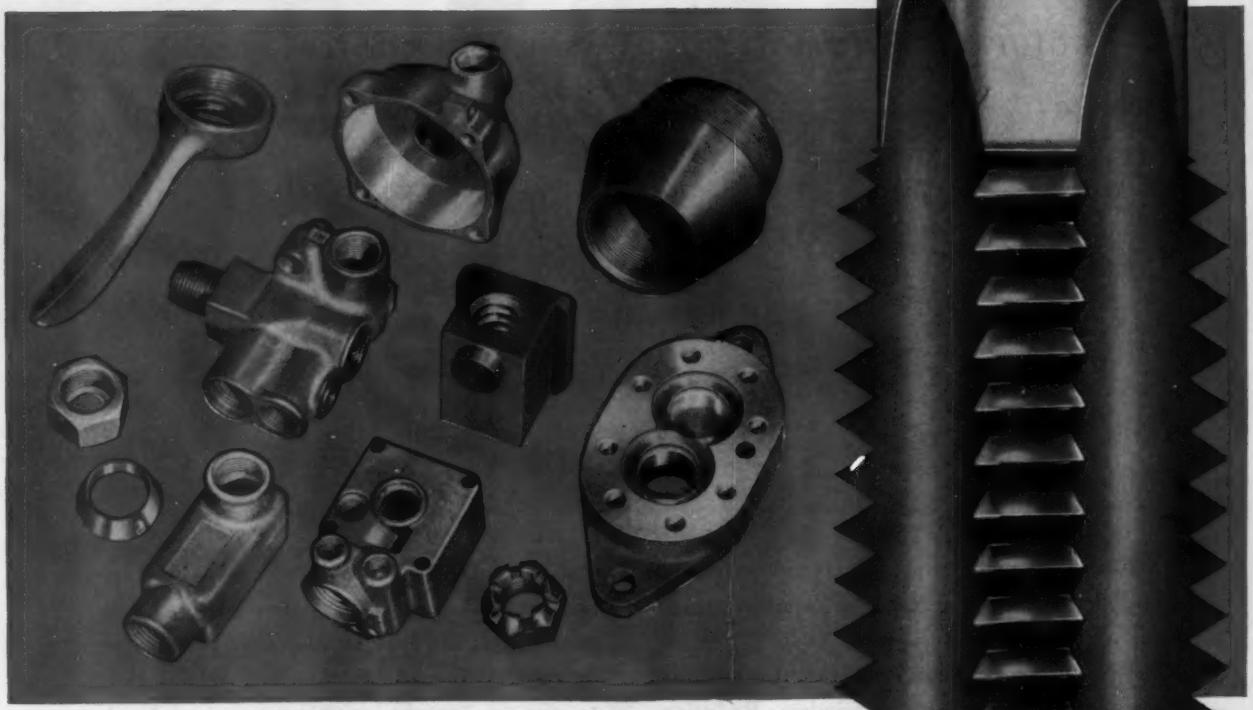
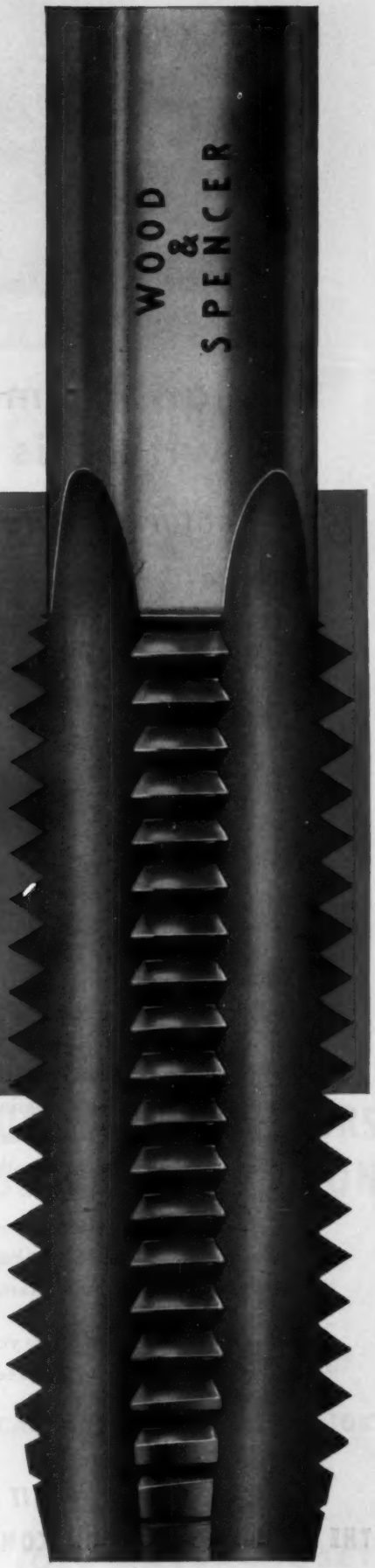
...Solve Difficult Tapping Problems





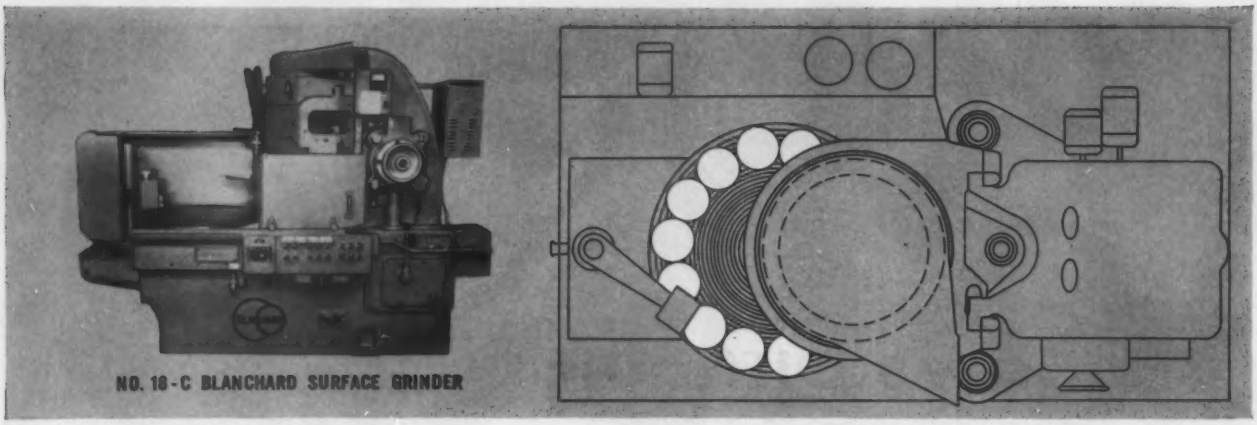
On routine jobs, tapping isn't much of a problem today. No matter whose taps you use, they are all about equally precise . . . and do a good threading job.

But, you may run into trouble on especially difficult tapping jobs. In fact, the picture above shows examples of tapping troubles we have solved, and which our customers considered difficult. In practically every case we have recommended practices which have resulted in substantial savings for our customers on their tapping operations.

We have many other examples on file, and we'll be glad to help you solve *your* problem if you'll call us.

Want a free tap guide: Everyone who has one finds this handy wall chart an excellent ready-reference. It tells all standard gage tolerances, class fits and tap tolerances. Write us for one on your business letterhead.

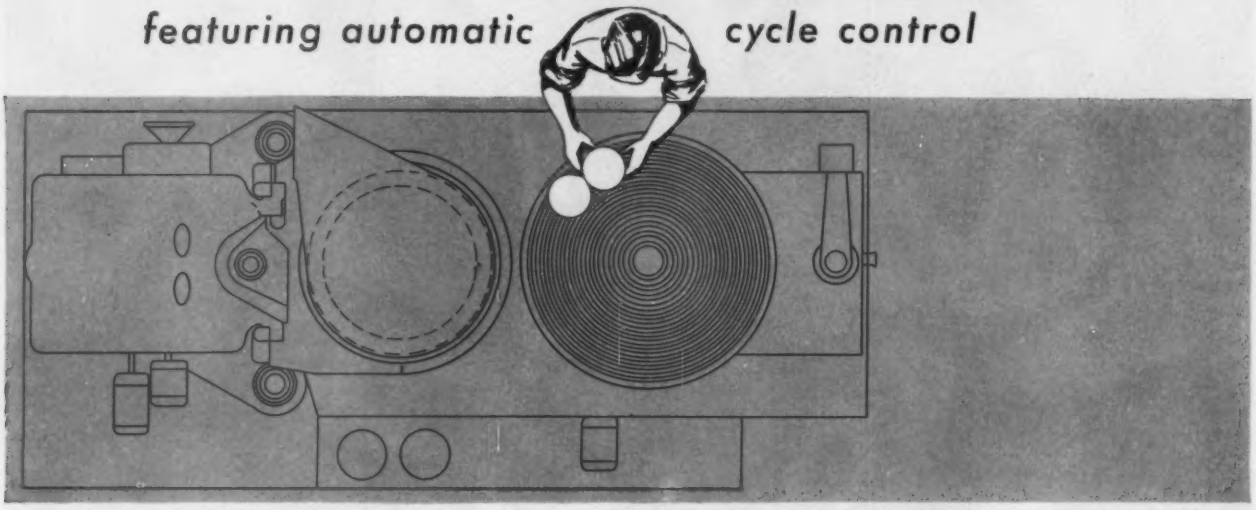
The Wood & Spencer Company • Cleveland 3, Ohio



NO. 18-C BLANCHARD SURFACE GRINDER

Plan for more profitable production with this new Blanchard Grinder

featuring automatic cycle control



This great new Blanchard has the speed and simplicity which guarantee economical grinding on a wide variety of jobs.

One operator can easily operate two of these automatic cycling surface grinders. By using the automatic cycle, he can unload, clean and reload one grinder while the other grinds automatically.

The automatic cycle does everything else: moves chuck (30" or 36" dia.) to grinding position and starts it rotating; starts wheel rotation and coolant pump; provides rapid wheel approach to work; engages power down-feed at preset rate; changes to fine feed just before finished size is reached; stops feed when work is to size — "sparks" out; raises wheel head; stops wheel, coolant pump and chuck; moves chuck to loading position—demagnetizes chuck.

The No. 18-C also features: push button selection of manual or automatic operation; automatic size control; simple feed and head traverse controls; adjustable dwell timer.

This new Blanchard offers you many new production advantages. Look into them today — write for free catalog showing work done on the No. 18-C.

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IN THE AUTOMOTIVE INDUSTRY, IT'S

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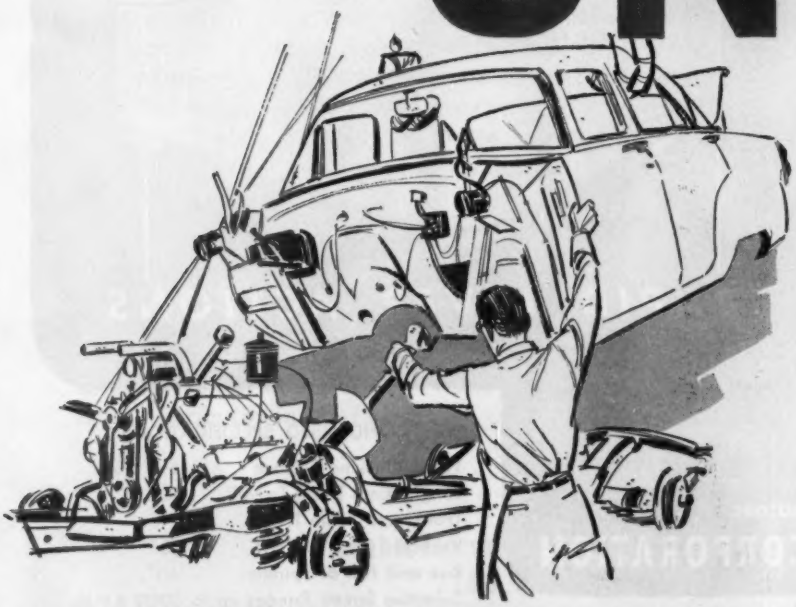

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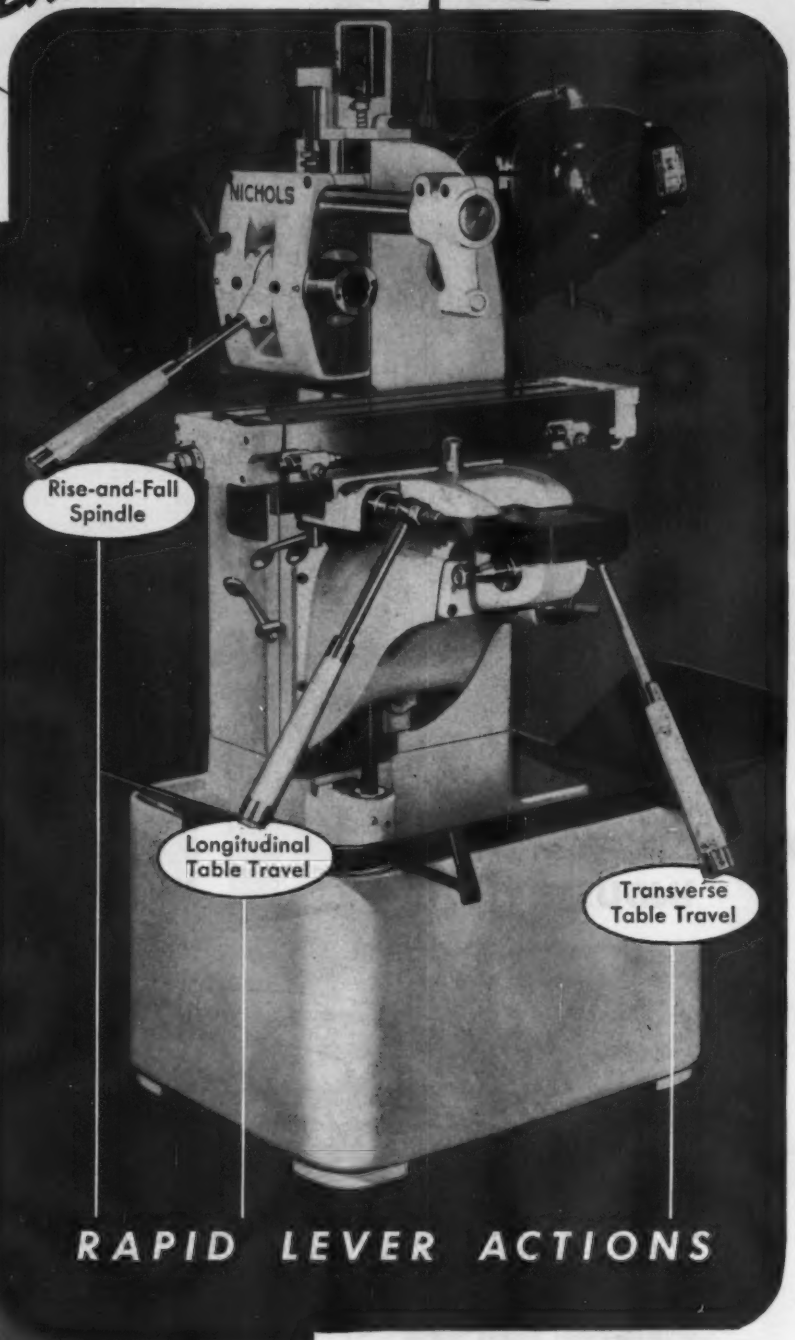

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PRODUCTION MODEL

Precision turning, boring and recessing jobs that are normally assigned to toolmaker's lathes or expensive boring machines, come natural to the versatile NICHOLS Millers.

Rapid Lever Actions on the Spindle Head, Table, and Saddle provide unparalleled flexibility of movements. The Lever Transverse Feed, an exclusive NICHOLS development, is especially valuable. Makes NICHOLS different from other hand millers. It adds *"lathe-carriage flexibility"* to your most intricate machining operations, while maintaining tolerances to "tenths." Work can be chucked lathe-fashion on the spindle with tools mounted on the table or vice versa.

Adjustable positive stops, quick-acting locks on sliding movements, and the highest degree of precision are standard equipment.

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Table Working Surface	6¾" x 21"
Longitudinal Table Travel	10"
Transverse Table Travel	7"
Vertical Travel of Knee	13"
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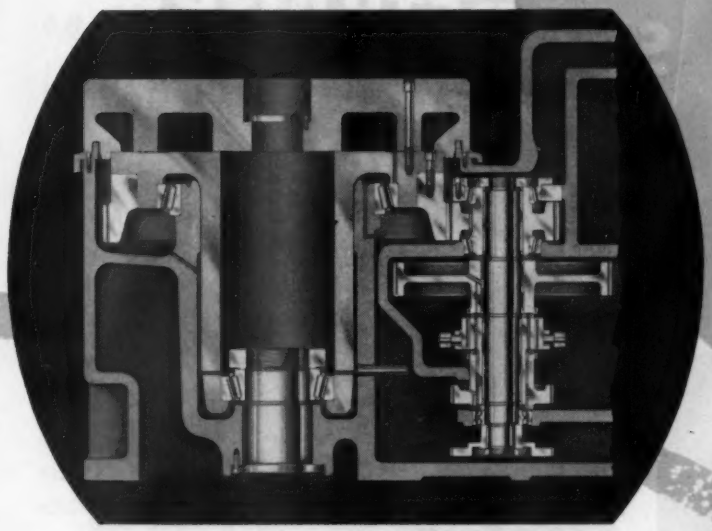
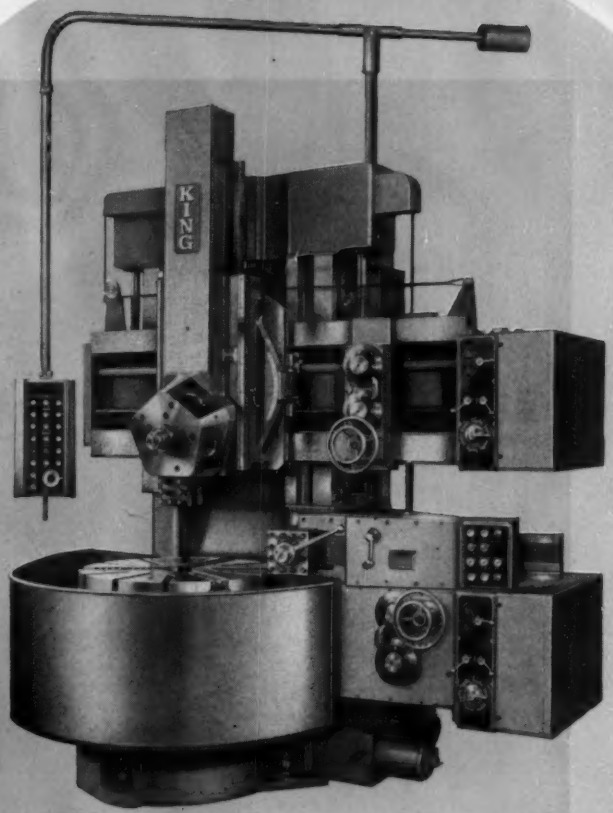
New features of the advanced design KING assure greatly increased accuracy





36" KING with Turret Head, Side Head, and Coolant Pan. Wide variety of head combinations available.

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Among the many improvements incorporated in new King® Vertical Boring & Turning Machines is the construction and mounting of the spindle. As shown above, the spindle itself is extra-heavy and rigid. Tapered roller, pre-loaded bearings are placed to provide extreme stability and accuracy of operation. Bearing adjustment as well as spindle assembly removal are quickly accomplished. Helical gear spindle drive completely eliminates any tendency toward spindle deflection. Lubrication is automatic and safety-interlocked.

With many other features—see listing at right—the completely redesigned KING will bring to boring mill users the greatest productive capacity ever achieved for vertical boring and turning work. For full details, send for new Catalog K-5 covering 30", 36" and 46" sizes. (Catalogs on larger sizes will be available later.) Write to us direct or to the King distributor in your area.

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24 feeds and 24 speeds available.

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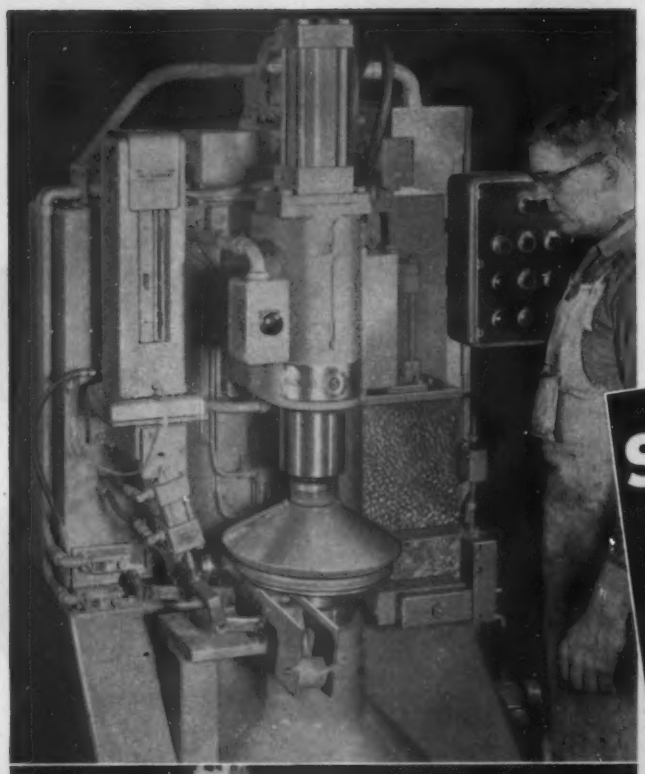
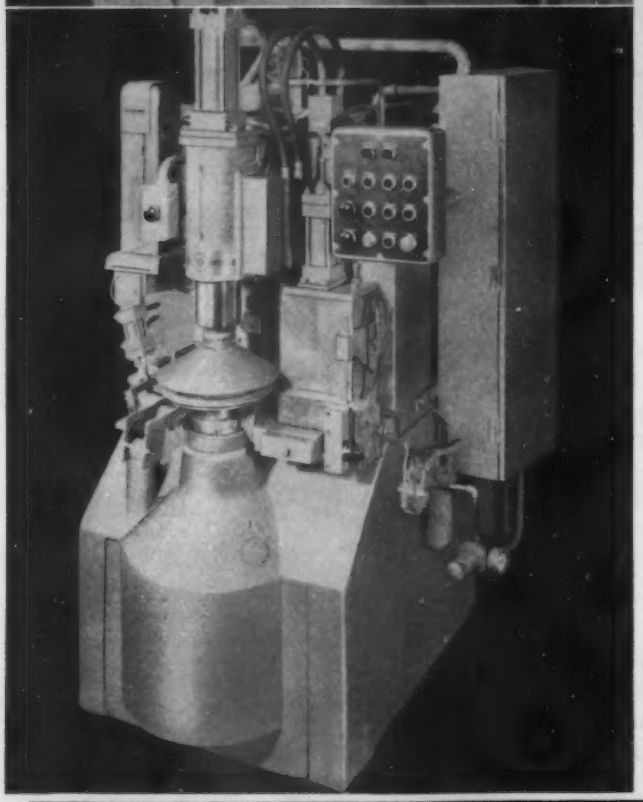
KING Vertical Boring and Turning Machines





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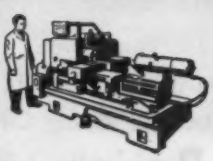
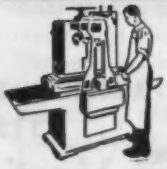
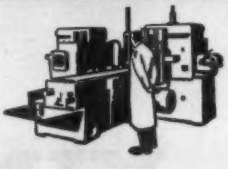






W!

a simplified basic design... easily adapted to problems in production work

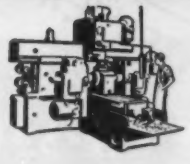
Oftentimes manufacturers have found it necessary to purchase "more machine" than needed to handle the production job at hand. This is particularly true for production turning operations. But here is a practical Sundstrand solution for a new machine of simplified basic design to which different slides can be applied in accordance with your work requirements.

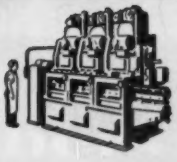
The new Sundstrand vertical lathe is designed so that one operator can handle several machines. It is an excellent example of a standard machine easily adapted to production work. It has the spindle, tailstock and slide mounted in a vertical position, thereby reducing the amount of floor space required and making it easy to apply automatic handling. Machine capacities range from 5 to 25 H.P. If you have production turning problems be sure to investigate this new machine.

for additional information

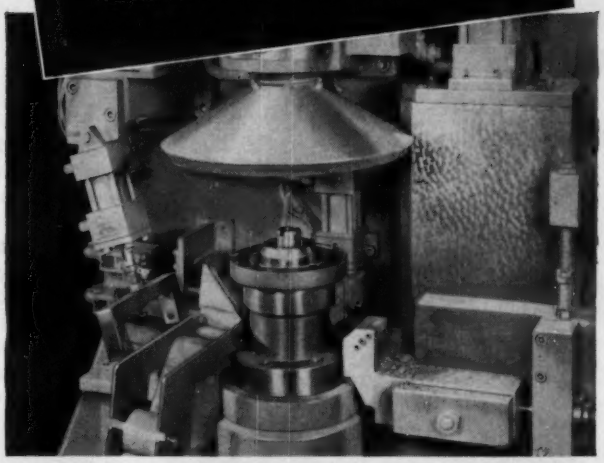
Concerning the possibility of profitably applying this machine to your work send part prints, production requirements and all pertinent information on your job requirements. We will be pleased to furnish you with a preliminary estimate of what you can expect in performance from this machine. There is no obligation for this service.

TRIPLEX RIGIDMILS | SPECIAL MACHINES

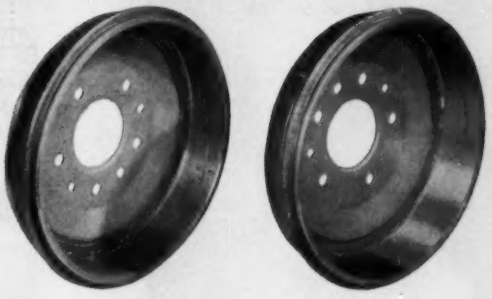




A TYPICAL INSTALLATION



Close up of tooling for brake drums and close up of operations, below.



In this installation the operations consist of boring the brake drum. An automatic sanding attachment is arranged to cycle with the machine operation to finish the machined surface. An automatic gaging unit indicates the size of the finish bore of the drum to maintain the desired accuracy.

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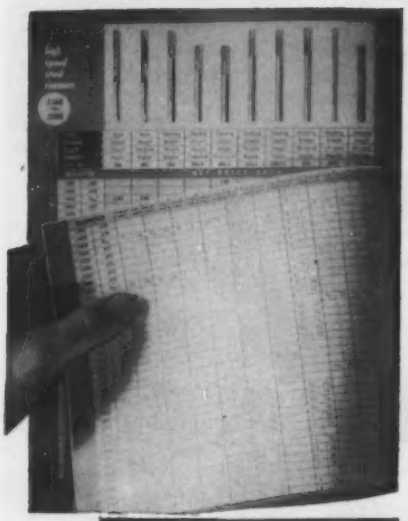

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Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Wrong Adjustment

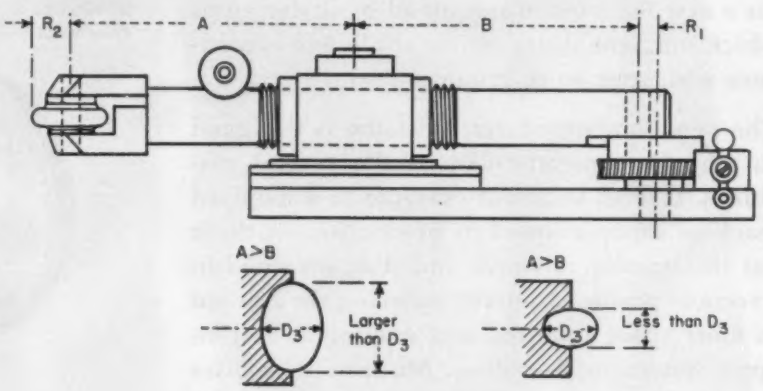
In reference to the Practical Idea for a grinding attachment for spherical sockets (*AM*—May 23 '55, p161) I would like to point out that changing the A:B relationship to alter the size of the sphere is incorrect procedure. The only proper solution is to adjust the eccentricity R_1.

If the radius of the ground sphere is R_3, eccentricity of drive R_1, radius of wheel R_2, distance from pivot center to wheel center A, and distance from pivot center to eccentric pin center B; then if $A = B$, $R_3 = R_1 + R_2$. But if the A:B ratio is changed, the result will be to produce an oval, as shown here.

L Szikla, mech eng,
New York City

You Said It, Brother

I am not in the habit of writing letters just to get my name in print, but this is one time when I must put in my two cents' worth to agree with Mr Heptinstall (*AM*—Sept 12 '55, p98). Everybody understands that



GRINETICS

By D G SMITH

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THE NEW — ALL ELECTRIC

6" x 18" *Reid-o-matic*

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with
PUSH BUTTON CONTROLS
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- ADJUSTABLE AUTOMATIC TABLE TRAVEL

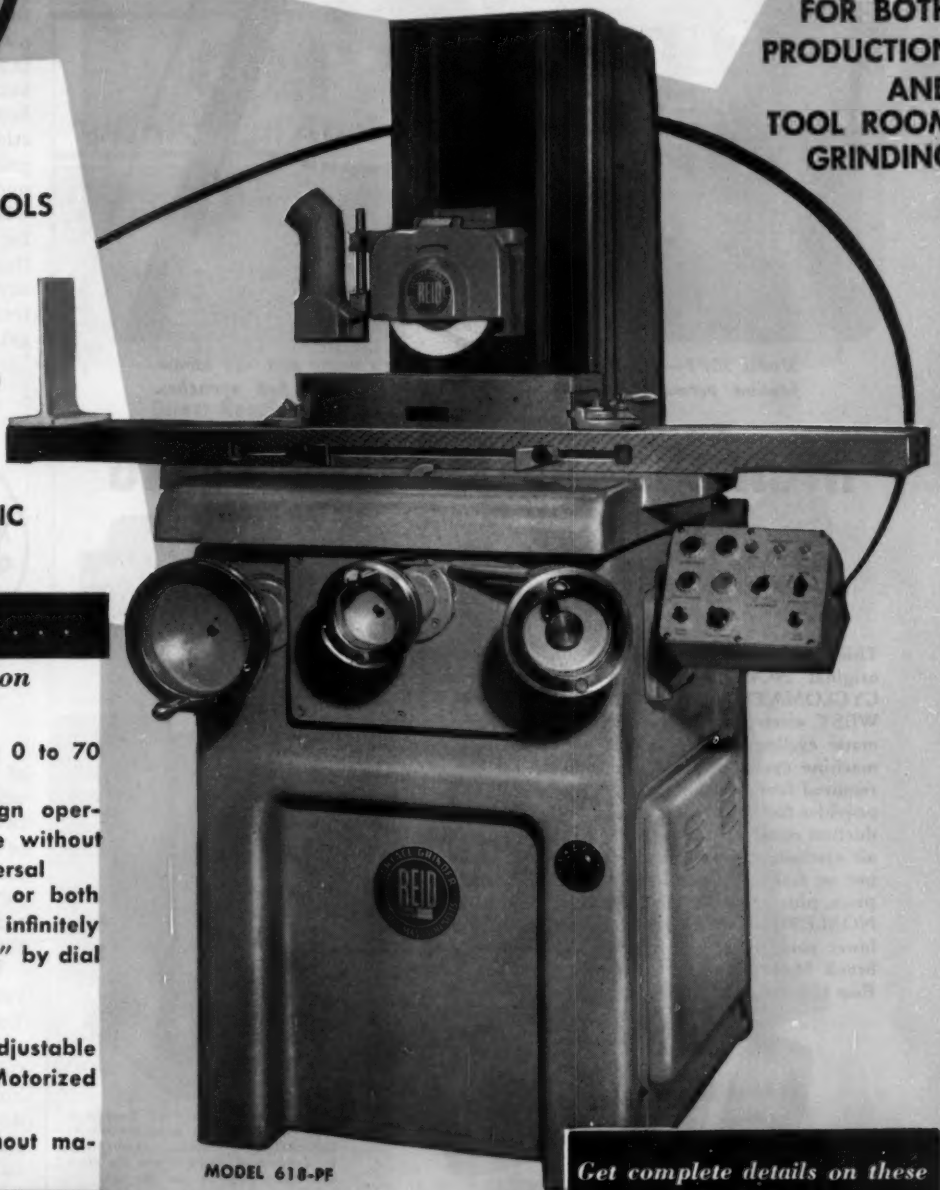

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TABLE SPEED: infinitely variable from 0 to 70 feet per minute

TABLE TRAVEL REVERSAL: new design operates table without motor reversal

CROSS FEED: instantaneous at either or both ends of table travel, infinitely variable from 0 to 7/32" by dial adjustment

GRINDING HEAD: new design with adjustable gibs — 1 H.P. Motorized Spindle

LUBRICATION: fully automatic throughout machine

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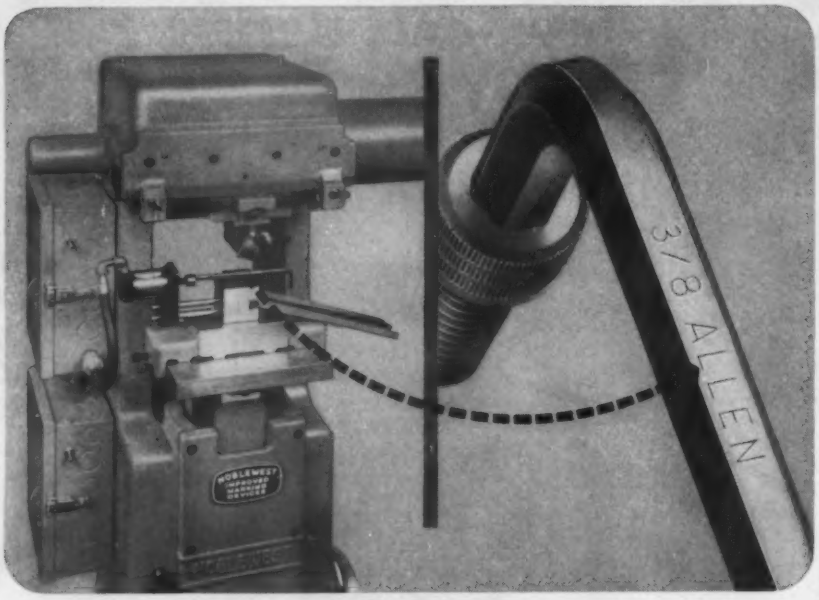


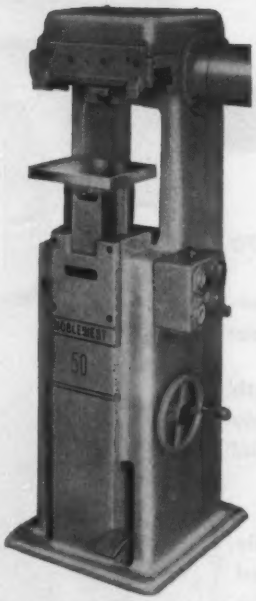
Model 50P1—395 Roll Marks manufacturer's name and size identification permanently into all sizes of Allen Head hex wrenches.

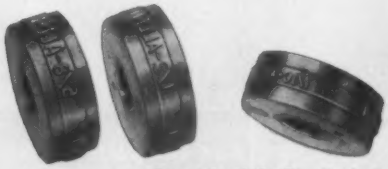
HIGH PRODUCTION MARKING

WITH NEW

Cyclomatic Control

This general purpose marking machine combines the original NOBLEWEST Roll Marking process with CYCLOMATIC CONTROL . . . an exclusive NOBLEWEST electro-pneumatic circuit for completely automatic cycling. When set for automatic operation the machine cycles continuously with no further attention required from the operator. A dual control system also provides for semi-automatic operation or for short production runs. This model can also be equipped with an air ejection system (see above) plus an automatic hopper or dial feed. The basic Model 50P1 features a low price, plus quick delivery! For additional details on how NOBLEWEST Marking Machines, tools and dies can lower your production costs, write the Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Conn.





At left are Noblewest Precision Roll Marking Dies used for marking Allen wrenches. Inscription is duplicated three times on each die, thus tripling the die life.

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MARK IT BEST WITH

NOBLEWEST IMPROVED MARKING DEVICES

NOBLEWEST

ORIGINATORS OF THE ROLL MARKING PROCESS

EQUIPMENT FOR MARKING · GRADUATING · EMBOSSING · NUMBERING

when the price of raw material goes up, the price of the finished product must rise also. But why must the poor consumer be penalized by getting it in the neck at both ends?

First of all, the manufacturer passes on the increase multiplied by three or four, then he finds out some way to use so much less of the material that he could really afford to reduce the price. As Mr Heptinstall points out, automobile makers are the worst offenders, and it is beginning to look as if they may be pricing themselves right out of the market. They are not really giving us *better* cars; all they are doing is sticking on fancy gadgets at fancy prices. For example, they have the nerve to charge $90 for a car radio when you can buy one equally good for about $40 in an accessory store. Buy a car without a radio, did you say? Brother have you ever tried it? Getting a car without a radio is like getting blood from a turnip. On top

of that, I have to trade in the radio when I trade in the car, after about two years. Now my home radio is seven years old and is probably good for another seven years, but I can't switch the car radio from car to car; I have to get a new one every time.

Why trade in my car after two years? Well, there's another gripe. Today's cars are made to last just about two years. After that, everything begins to let go like the one-hoss shay. I don't know how they do it, but they seem to have everything timed to a T. Look at the battery. If it has an 18-month guarantee, you can bet your boots it will give up the ghost within two weeks of the end of that period. Body paint will last just about two years, then the rust will begin to eat through. Everything else is timed the same way.

They strongly recommend undercoating and pretend it is to make the car quieter and to protect the metal. If the metal needs that much protection, why doesn't the maker do it in-

stead of charging for it as an extra? The truth is, the metal is so thin that it will vibrate like a drum and corrode in no time at all. It's the same old story; make the thing cheaper and sell it for more. Or they'll change the shape of the combustion chamber—which costs little or nothing—and then charge like the devil for the additional horsepower they are *giving* you. Horsepower you don't want and can't use.

Are manufacturers too stupid to see the writing on the wall? Sales of foreign cars are zooming because of solid quality and lack of gadgets, plus styling that lets you say, "the devil with the Jones'" let them keep up with me.

Philip Brandeiser
Chicago

Old Cars

Reading Mr. Colvin's letter (*AM*—29 '55, p122) in which he mentioned the Pierce-Arrow, reminded me of other things in which that fine old company scored a first. Modern headlights are mounted in the fenders, but Pierce-Arrow put them there over thirty years ago. And there's a lot of talk about the increased amount of aluminum being used in the engines. Well, P-A built an all-aluminum engine over 30 years ago, including the block and everything. I don't remember about the chassis, but I know the front axle was aluminum and, of course, the body.

It didn't catch popular fancy because aluminum was pretty expensive in those days and people thought of it as a dead-soft material, not knowing its alloys could be heat treated to about the same strength as steel. But the trial runs were quite successful. If today's makers would look back occasionally they would learn a lot to guide them in the future.

Robt Beardsley
Buffalo, NY

COSTS Go DOWN with UP Goes PRODUCTION

OLIVER ACE
Universal Tool and Cutter Grinders

Simple to set up, easy to operate, the OLIVER ACE handles a wider range of cutters than do ordinary cutter grinders, yet requires no computation. With the ACE, time lags are cut to the bone . . . the simplicity of design and operation make economy of motion and fast grinding certain. The time-proved, soundly engineered Oliver ACE effects economies in floor space and less outlay in dollars for this truly superior type machine.

Direct Reading for Clearance
—Reduces Fatigue
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Especially qualified for grinding tungsten-carbide and high speed milling cutters and tools, the Oliver ACE has only one sliding part with ample bearing, efficiently protected from dust. Only two simple fixtures are required for a general range of cutters. Quick, accurate and easy . . . the ACE is maintaining its long-standing reputation in thousands of plants for doing the job for which it is built.

Priced to meet your budget, the ACE excels for grinding face mills up to 15"—also, slab mills • slitting saws • dovetail cutters • angular cutters • double angle cutters • Fellows helical cutters • reamers • taper reamers • production gashing and carbide tipped circular saws.

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MACHINE TOOLS by OLIVER include:
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craftsmanship at its finest

Typical of the pioneering leadership that has marked Starrett's 75 years of service to industry are the many new Starrett Tools now available through your Industrial Distributor. Ask him to show you these new tools or send for your personal copy of the big new Starrett 75th Anniversary Catalog.

For demanding work, skilled craftsmen rely on the unfailing accuracy of Starrett Tools, the same fine tools you use in your own shop for all precision measuring operations.

Keep in mind, too, that in addition to mechanics' hand measuring tools and precision instruments, Starrett also makes dial indicators, hacksaws, band saws, hole saws, band knives and precision ground die and flat stock. All of these precision-made products are readily available through the same convenient and reliable source of supply — your local INDUSTRIAL DISTRIBUTOR.

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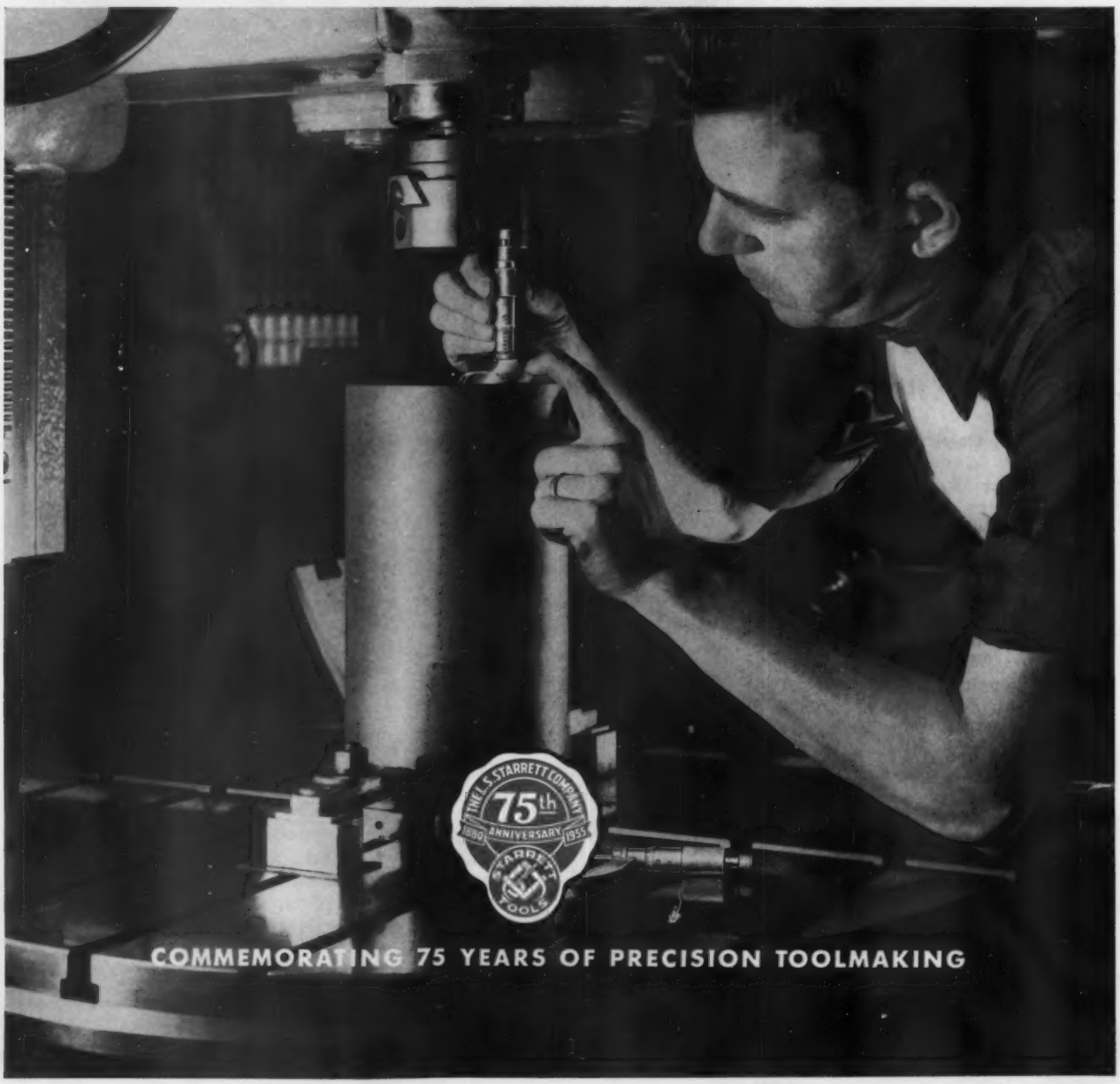
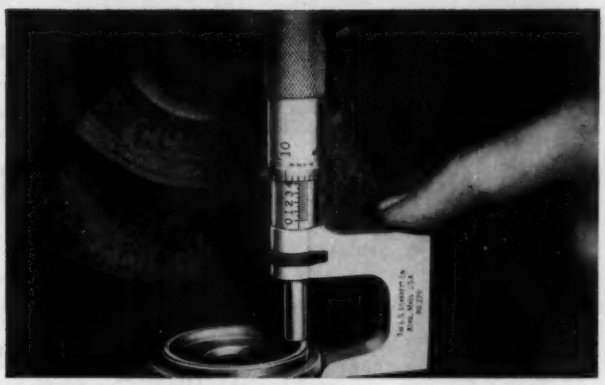
that Speed and Simplify Precision Measuring



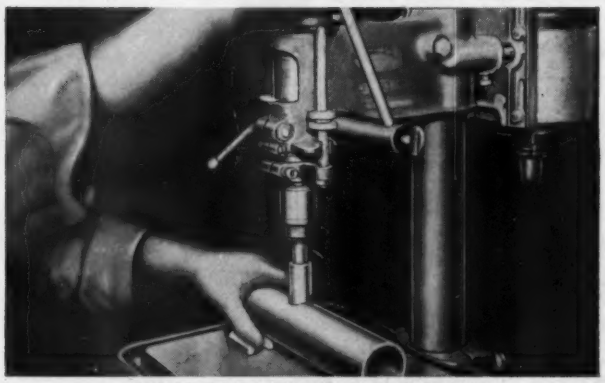
NEW ODD FLUTE MICROMETERS

No. 483 and No. 485 measure 3 or 5-fluted cutting tools, eliminate special fixtures. Read direct in thousandths. Satin Chrome Finish with carbide facings on anvil and spindle.



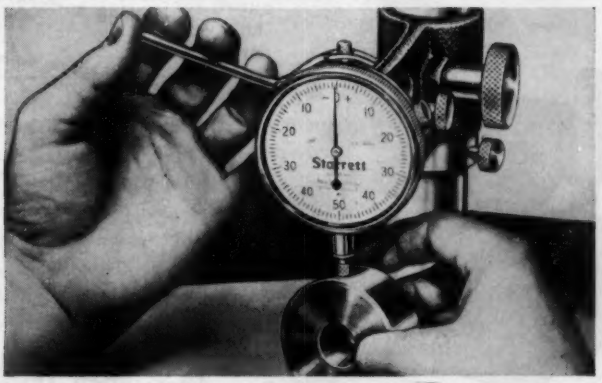
NEW MUL-T-ANVIL MICROMETERS

No. 220 is now available in 0-1" and 1-2" sizes. Vise-type frame holds round or double-ended flat anvil (furnished) — also special anvils. With vise jaw removed, also serves as height gage.



NEW SAFE-FLEX® HOLE SAWS

New double-welded, shatterproof hole saws for cutting large diameter holes in metals, plastics, wood. Interchangeable arbors hold wide range of saw sizes. Shanks fit portable power tools, lathes, drill presses, etc.



NEW DIAL INDICATORS

New high precision-low friction dial indicators feature simplified construction, easy-reading dials, no-glare Satin Chrome Finish on case. 140 models meet every quality control requirement.

NEW UNIVERSAL PRECISION GAGE

No. 995 with fine adjustment and range up to 10¼" can be used as surface or height gage, planer or shaper gage, adjustable parallel, scriber or precision base for "Last Word" indicator. Form ground flat and V ways eliminate side play.

NEW TOOL AND INSTRUMENT OIL

The same extra-fine lubricant made especially for Starrett now available to protect and preserve your fine precision tools. Starrett also offers a new easy-to-apply layout dye . . . both in handy tool box size cans.

BIG NEW CATALOG NO. 27

New 75th Anniversary Catalog describes and illustrates the complete Starrett line. Ask your Industrial Distributor or write for free copy. Address Department

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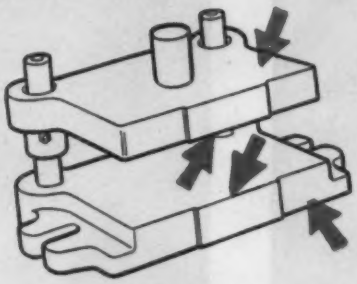
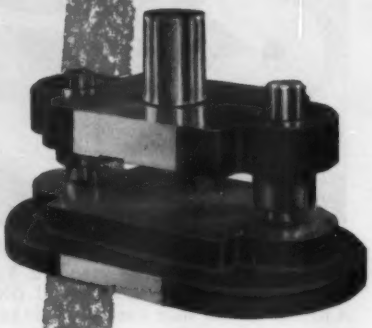
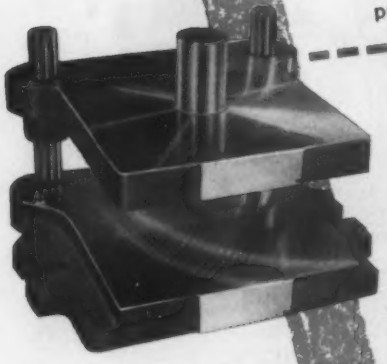
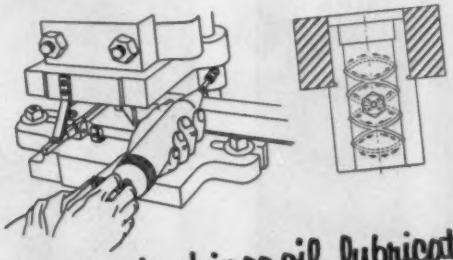




all horizontal surfaces ground

Now, in addition to the vital die surfaces of all steel or semi-steel sets, all horizontal surfaces, including tops of punch holders, are ground with the same precision that has made Danly quality the accepted standard. Surface grinding assures a flat, true working surface, saves tooling time and improves accuracy.





Shoulder bushings oil lubricated

All Danly Standard Sets equipped with shoulder bushings are designed for easy, pressurized oil lubrication. Fittings in bushing shoulder are easily reached from front or side. Cut-away sketch shows oil channels in bushing that form lubrication reservoir for long runs and maintain oil film with a minimum of clogging or gumming.

New features like these keep DANLY ahead

Throughout the years, the rigid precision standards of Danly have made Danly Die Sets the recognized standard for quality. Now Danly Die Sets offer you two new features to save hours in the die shop, make tooling-up much faster and assure longer die life. All new Danly Die Sets have an oil lubrication system for shoulder bushings and all horizontal surfaces are ground to assure a true working surface for die making. Danly's nationwide system of assembly branches is ready to serve you. Call Danly today.

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DANLY

Spot News of Metalworking . . .

- **Unalloyed titanium is being cold extruded with smooth, ungalled surface** at Battelle Memorial Institute, using a special fluoride surface coating that acts as a gliding agent and lubricant retainer. Battelle metallurgists have produced extrusions with reductions up to 70% at same pressures as those for steel.

Firms in flood-disaster areas can lease government-owned machine tools for 90 days rent free, by authority of a new Office of Defense Mobilization directive to the Commerce and Defense Depts. Rental charges will begin 90 days after delivery of equipment to insure that all equipment needed for normal operation is in place before rental charges become effective.

- **Finished forgings from AF heavy presses are saving the Air Force millions** of dollars in material and machining costs, as opposed to machining the same parts from rough-forged billets. Example: a finished jet-plane bulkhead cost $11,210 by the rough-billet method; same part heavy-press forged was $5266.50.

- **Some carbide producers say they'll go along with the 10% average price rise** recently announced by Carboloy, as will firms servicing carbide users with new tips, but one top carbide producer says flatly it "anticipates no price rise in the near future," will honor all quotes for 30 days, and would give two-weeks' notice if it should decide later to up prices.

Cleveland metalworking firms are letting down the age barrier for skilled engine and turret lathe operators, boring mill operators, tool and diemakers, cold-header operators and skilled foundrymen. Any such men between 50 and 60 are welcome in hard-up-for-skilled-help Cleveland industries.

- **Stainless steel that's fabricated at room temperature and hardened at −100 F** will be displayed at the Metal Show in Philadelphia next week.

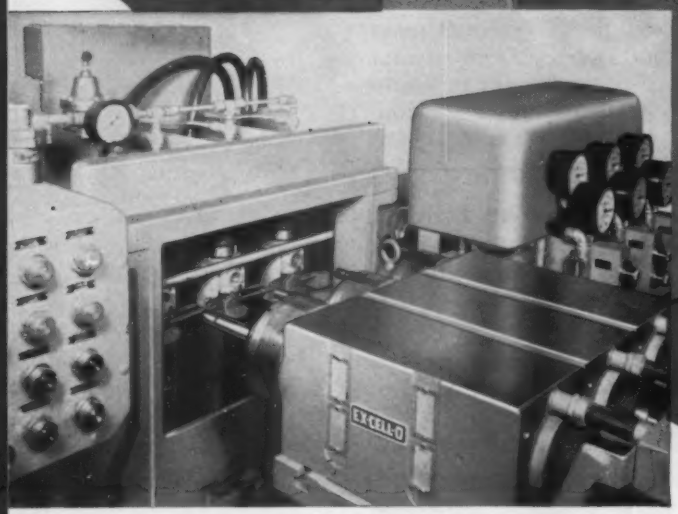
- **Chrysler is making kerosene engines for Mexican tractors.** The engines, with a kerosene manifold adaptation, are made for Tractores de Mexico S A, Mexico's first tractor plant. Reason: gasoline is out of purse-range of the Mexican farmer.

- **Jet planes for the Japanese Air Force will be assembled in Japan within two years.** The U S government is underwriting two-thirds of the $57 million project, aimed at building up Japan's air defenses. North American and Lockheed are providing Japanese builders with management and technical assistance in the building of 70 F-86's and 100 T-33's.

- **10,000-kw gas turbine is being assembled in a British powerhouse.** It's a two-shaft, open-cycle set with intercoil and heat exchanger operating at 650 C max, with a compression ratio of 5.5:1. Thermal efficiency is rated as high as 26.7%. Exhaust gases heat the powerhouse, increasing efficiency to 41.6%.

- **Ford's new "Operation Readiness" program** (aimed at reducing tank output time in case of national emergency) has a one-year government contract to (1) determine number of tank parts changed since Ford stopped tank output in 1953, (2) find whether former methods apply to current tank model production, and (3) study mothballed equipment to see how many tanks it could put out per month.

Style 112-D Ex-Cell-O Precision Boring Machine equipped for automation. Operations: Transfer mechanism moves three parts at a time from conveyor to fixture, to gaging station (optional), back to conveyor.



Net production is 300 pieces per hour. Three pistons are machined simultaneously by three motorized spindles each carrying semifinish and finish boring tools.

Standard EX-CELL-O Machine Equipped for AUTOMATION

FAST, ACCURATE PRECISION BORING OF WRIST PIN HOLES

Pistons are brought automatically from the conveyor to boring position, three at a time. Operations are fast and accurate, producing a fine finish.

Automatic Inspection equipment may be incorporated, with lights to indicate size limit warnings and rejections; a rejection stops the machine.

Call your Ex-Cell-O representative or write Ex-Cell-O in Detroit for complete facts on this or similar production savings opportunities through automation.

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- DAIRY EQUIPMENT

55—46

Washington . . .

Business impact of President's illness . . .

Topic Number One in Washington is President Eisenhower's illness, how it will affect the Republicans' future, and what it means for current government policy related to business.

On the political side, there's almost unanimous belief that the President will not run for a second term and that Democratic chances for victory in 1956 are therefore enhanced. This has stirred up the fear that the President's illness might in itself halt the boom and start a decline. But government economists are now stressing consumer buying as the major factor in the boom; they don't feel general consumers will be nearly as uneasy as businessmen about the effects of the President's illness.

The President's absence could throw a monkey wrench into upcoming policy-making. For instance, Eisenhower has kept budget-balancing high among his administration goals. He has taken an active part in cutting military spending. But right now, the Defense Dept is in the throes of budget-drafting. Secretary Wilson's alleged aim is to keep fiscal 1957 military appropriation requests at the same level or below the $31.4 billion voted for fiscal 1956 by Congress.

But the services are pushing hard for more money. The Air Force would like to go beyond 137 wings and step up research and development on intercontinental ballistic missiles and nuclear-powered aircraft. The Navy wants more money for both nuclear-powered planes and ships. The Army wants more men to handle training of the new reserve forces. And as each of the services get into newer, more complex weapons, procurement cost rise.

Meantime, there's still the struggle over fiscal 1956 expenditures (see p198). Treasury Secretary Humphrey is putting the heat on the Defense Dept to clamp down on current spending; a 3% cutback would probably balance the budget. But the Pentagon is straining just to get down to the $34-billion expenditure level estimated for Congress last January. In the past, Eisenhower has usually settled these issues on the side of cutbacks. Without him, it's anyone's guess who will come out on top — Humphrey or the Pentagon. Much depends on whether Eisenhower personally can take a hand in matters over the next two months.

Upcoming tariff cuts . . .

U S metalworking industries are sure to be hit by a new round of tariff reductions. In January, the U S will meet with about 25 other nations at Geneva to negotiate reciprocal tariff cuts. The U S is considering offering tariff concessions on some 900 products making up 31% of this country's dutiable imports. Under the recent extension of the Trade Agreement Act, the President has authority to reduce tariffs by 15%.

The State Dept feels politically sensitive products have been screened out of its proposed concession list in advance. An effort was made to leave out items wherever there was reason to suspect tariff cuts would impair national security or injure domestic industry.

But that's only State's belief. Some domestic industries will disagree. They will get a chance to put their objections on the record during extended public hearings in Washington, starting October 31. Only when these are completed will the government make final decisions on actual concessions to be offered.

Here are some important metalworking products on the proposed concession list: twist and other drills, reamers, milling cutters, taps, dies, die heads, and metal-cutting tools of all descriptions, and cutting edges or parts for use in such tools, textile machinery, and miscellaneous machines. For a detailed list of the products, write to Superintendent of Documents, government printing office, Washington 25, D C, ask for State Dept Publication 5993, Commercial Policy Series 151 ("List of Products to be Considered . . . Negotiations Under the Trade Agreement Act"). Price 30 cents.

"New curbs" on defense news phony . . .

Recent press accounts about "new curbs" on release of information by defense contractors are mostly scare stories. The so-called curbs have been in effect since 1953, were slightly revised in January. The revisions were finally printed in the Federal Register last month. That's why the stories at this time.

Actually, military officials can only "advise" contractors on the release of non-classified information, and then only "when requested by management." That's been the rule for over two years. The Pentagon has periodically tried to tighten up on this policy. But the impracticability of direct government censorship of non-classified information released by a defense contractor has long been obvious not only to the press but to most industry people, too.

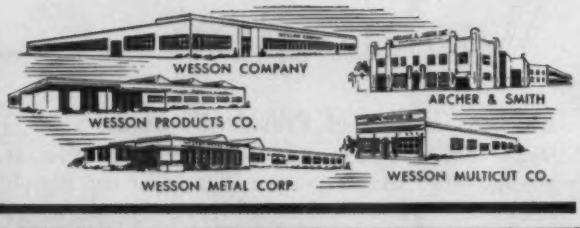
Progress payments on defense contracts . . .

The Pentagon is likely to revise the progress-payment clause in defense contracts to limit payments to 75% of total costs and 90% of the value of direct labor and materials. The revision is aimed to emphasize military title to all tools, inventories, and work in progress, help contractors offset local efforts to tax capital equipment and inventory which don't actually represent private investment.

Probe jets that "won't fly" . . .

House Military Operations Subcommittee has started a probe of alleged "faulty procurement" of jet fighter planes by the Navy. Rep Karsten (D, Mo) charges the Navy accepted delivery of about 50 McDonnell F3H-1 "Demon" aircraft equipment with Westinghouse J-40 engines not powerful enough to fly the planes. He wants to "assess the responsibility."

carbide NEWS

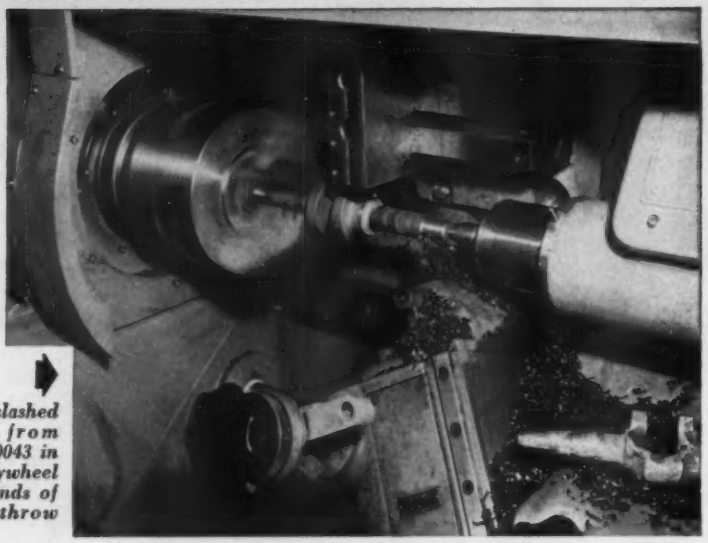


Grade 26 Cuts Tool Costs 88%

New wide range grade and holder boost pieces/grind from 85 to 800

A reduction from approximately four cents to less than ½ cent per piece in tool cost has been achieved in the machining of single-throw Arma Steel crankshafts by a midwestern machine company. These savings were obtained despite an increase in blade cost of 41% over the style previously used.

The savings were achieved in two steps. The first revealed that Wessonmetal Grade 26 would out-perform all other grades by an average of 50 pieces per cutting edge. The next step was to adopt a Wesson Multicut holder. This helped to increase tool life to 200 pieces per cutting edge. With four edges per insert, life is 800 pieces per grind, as against the original 85. Part of the overall increase is due of course to the rigid construction and support provided by the new holders.



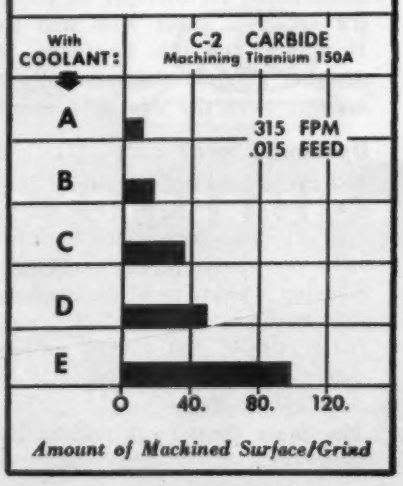
26 Carbide slashed tool cost from $0.038 to $0.0043 in machining flywheel and pulley ends of this single throw crankshaft.

Operations consist of rough and finish turning of the flywheel and pulley ends of the 220 Brinell steel crankshaft. Machining is being done dry on a 20 hp New Britain tracer lathe at 1210 rpm and .014" feed. Depth of cut averages ¼ to ⅜-inch.

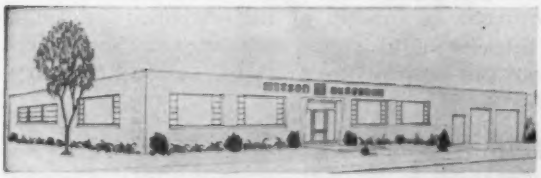
In achieving the savings, no changes were made in speeds, feeds or depths of cut.

Tool Hints...

The cost-cutting story told above re-emphasizes the necessity of studying ALL the factors contributing to tool performance if maximum economies are to be obtained. In this case, the answers lay in (a) the carbide metal and (b) the tool holder. Sometimes it may be the coolant which will provide a major saving. In the chart below, for instance, are shown relative lives of the same tool material at the same speeds and feeds using five different types of coolant in the machining of Titanium 150A! A C-2 grade of carbide was used and feed was .015" at 315 ft. per minute.



New Carbide Research Center



New concepts in carbide boring and milling cutter designs may result from new research programs now under way at Wesson. Included are milling cutters utilizing "throwaway" carbide blades.

To house Wesson's expanded product development and tool application research facilities and staff, a new one-story structure has been completed adjacent to Wesson's Detroit plant.

The new research division will supplement the basic metals research carried on in Lexington, Kentucky at the new metals plant of the Wesson Metal Corporation, now producing all Wessonmetal carbides.

The new research division is under W. B. Bader, Vice President. It is being completely equipped for fabrication as well as testing of new tool designs. Lathes, milling machines, grinders, etc., are included in the equipment.

tools Wesson carbide Wessonmetal

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Detroit . . .

New Ford and Mercury engines for '57?

That's the talk around Detroit. And Auto Row people are guessing that the 1957 Thunderbird, and possibly one other Ford make, will feature fuel injection. But there are still a lot of bugs to be ironed out, such as fuel supply difficulties and high cost, before fuel injection goes on the market.

"History-making contract" . . .

is what both parties are calling the recent UAW-CIO settlement over at Campbell, Wyatt & Cannon Foundry Co in Muskegon. Eight years ago, these same two principals slugged it out to the tune of a several-months-long strike.

This time they reached a new contract after only 8 hours of negotiation. It covers 2500 workers and is closely patterned after the Ford-GM "guaranteed annual wage" settlements in its supplemental unemployment compensation aspects.

It looks like this is the pattern that CIO will follow in most future bargaining with industries related to the automotive business. On top of unemployment supplements, workers got wage hikes of 4 to 14¢ an hour, more health and welfare benefits. The contract runs for three years with annual increases.

Autodom and the Machine Tool Show . . .

How important was the Machine Tool Show to automakers? This may give you an idea. Two major auto firms sent what they termed "representative" delegations to the show, each made up of two or three men. In both cases, just after the show opened, there were frantic telephone calls to the home base to "send over the first team, quick!" and an ensuing scramble for Chicago hotel accommodations for the duration of the show.

Said one auto executive, "Frankly, we didn't expect or anticipate a show with the scope that was presented. We won't underestimate the Machine Tool Show again, believe me."

Eight-million cars next year?

is the most optimistic prediction made to date by an auto official. It's the opinion of Cadillac's general sales manager, J M Roche. He ought to know —Cadillac will be in the thick of the percentage-of-the-market fight next year, battling to hold its considerable lead in the luxury car field not only against its traditional rivals (Lincoln, Chrysler's Imperial, and Packard) but against the all-new Continental Mark II, and one of its own GM stablemates—a more powerful Buick Roadmaster.

Cadillac is arming itself for the fight with $35 million worth of automatic transmission development so far this year, and $29 million for tooling up its 1956 models. And there's every indication that tooling expenditures will rise considerably on the next go-round. Add in such facts as acquisition of 6.5 acres across from its present Detroit plant, and a considerable step-up in employment and production, and you can see Cadillac plans to hold its luxury-car supremacy against all contenders, come what may.

"Hundreds of millions" is Chrysler's announcement of what it will spend for plant and equipment in the next 10 years to back up its fight for 20% or more of the market. Of seven plants slated to be built by Chrysler, two will be on the East Coast.

Mercury is upping production at its Livonia, Mich, transmission plant, and Mercury's arch rival, Buick, says it will increase production from 800,000 or so cars this year to 900,000 in 1956, and 1 million in 1957. Buick production facilities aren't nearly up to those of Ford and Chevrolet, and it has a long way to go to oust either of those makes from second place.

'56 is the hump . . .

that most automakers feel they have to get over to reach the promised land of a constantly rising market. While 1956 is expected to be a "good" year and the Cadillac, Mercury and Buick people even predict new records, there is an undercurrent of feeling around Detroit that there may be some trouble ahead for the automobile industry in the summer months of 1956.

Buick's Ivan Wiles doesn't share this view at all: ". . . even the experts have consistently lacked the imagination and the capacity to predict upcoming markets. We (at Buick) feel that the boldness of today's thinking about the future will be overtaken by tomorrow's market."

Lull or no, automakers are planning tremendous capital goods and tooling expenditures to get the 1956 lines out.

They're looking to the upcoming "war babies" market to bolster new car sales in the next few years and to overcome any lull in 1956.

The "war babies," born in 1941, and later, will be of car owner age starting in 1957. They won't be new car owners right off the bat, except in isolated instances, but as one GM sales executive puts it: "Those kids will be in the used car market with a bang. And when the used car market is boiling we sell a lot of new cars."

5203-R

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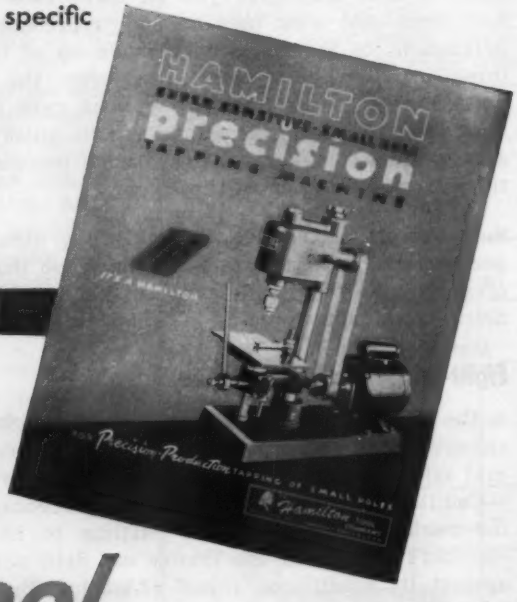
There is no way under the sun to do small, precision tapping with "production" speed, satisfactory tap life and acceptable accuracy, other than to use a tool designed for the specific purpose.

THE *Hamilton* SUPER-SENSITIVE SMALL HOLE TAPPING MACHINE IS SUCH A TOOL!



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Address The Hamilton Tool Company,
830 South Ninth Street, Hamilton, Ohio.

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USE IT WITH CONFIDENCE

Machine Tools . . .

Buyers have not held back orders . . .

New orders for machine tools this year explode the theory that buyers hold back from placing business in the months immediately preceding a big show.

Bookings through the first eight months of 1955 were considerably higher than anticipated. They were especially big in June, thanks to the Air Force.

But even in July and August, just before the show, new orders were good. They were better, in fact, than in any month during 1954.

August orders stood at 221.1 on the NMTBA index (1945-1947 = 100). They were slightly above the July figure.

Shipments in August were at 165, up 12 points from the previous month.

The industry now has bookings almost equal to six months' production at the current rate. In January, the backlog was under four months.

Rule on leasing under fire . . .

The recent Internal Revenue ruling on leasing of industrial equipment has come under the critical fire of the Machinery & Allied Products Institute.

MAPI will present soon to the Internal Revenue people a brief pointing out the inconsistencies in the ruling and asking that the ruling be revised.

One of the fundamental defects in the ruling, MAPI charges, "is the consistently negative approach which focuses almost entirely on the possibilities of abuses of leasing."

The ruling, moreover, raises serious questions about the use of diminishing rental schedules or option-to-purchase prices based on any realistic depreciation method.

The reasoning and language of the ruling "casts a shadow on any graduated rental payment schedule, especially when it results in total payments over any period of the life greater than the accumulated level or straight-line payments."

No formal procedure is named in the ruling whereby actual or prospective lessors and lessees may quickly obtain prior clearance of leasing plans of a special nature. Nevertheless it still is desirable to obtain clearance of any leasing program by specific ruling before it takes effect, if that is possible.

You may secure a copy of the MAPI bulletin on leasing (No 3311) by writing to MAPI's Washington office at 1200 Eighteenth Street N W.

At least two machine tool builders that have formal leasing plans say privately that the Internal Revenue ruling does not affect them adversely.

One of them points out specifically that he has been careful to emphasize all along that he does not take any responsibility for the tax problems of his customers.

Non-defense leasing deals are up . . .

Two more deals are up involving leasing for non-defense work of government-owned production equipment.

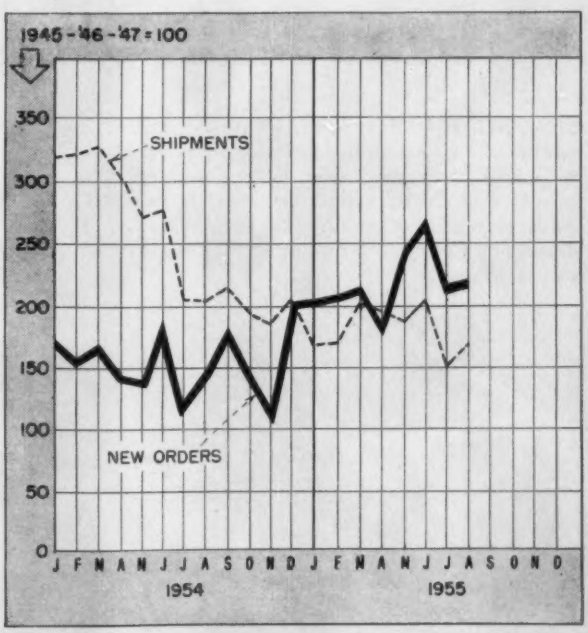
Thompson Products wants to lease $1.3 million of Navy machines to make aircraft and engine parts for non-military customers. The equipment was formerly used for machining J-57 jet engine blades.

Riverside Foundry, Bettendorf, Iowa, would like to rent $300,000 of Army Ordnance furnaces, molding equipment and similar machines.

Defense Department order issued last January, allows monthly rental rates on production equipment up to 2% of acquisition cost, the rental depending upon the age of the machines.

The fact is that no tools have been rented at more than 1%. This rate yields a return of 12.7% on a one-year term, 14.4% for three years, and 16.3% for five years. ODM says this rent is "in line with competitive enterprise and therefore adequate."

At least one machine tool builder is taking a long look at the work-handling equipment that helps to automate his machines, with an eye on the desirability of producing it himself. He likes the extra volume that would accrue from manufacturing the equipment that is really part of his machine when the latter is installed in an automatic production line.



AUGUST NEW ORDERS AND SHIPMENTS for machine tools rose slightly over those for July on the National Machine Tool Builders' Association Index. New orders for August were at 221.1 Index, compared with July; shipments went from 152.9 to 165.0

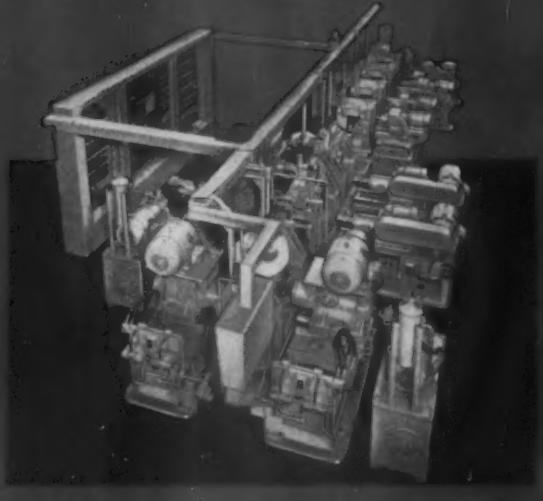
SNYDER SEGMENTED AUTOMATION in 91 station, 182 operation, in-line transfer machine features four segments which can operate independently or as a unit to assure continuous production of automotive automatic transmission cases at 100 cases an hour at 80% efficiency

SNYDER

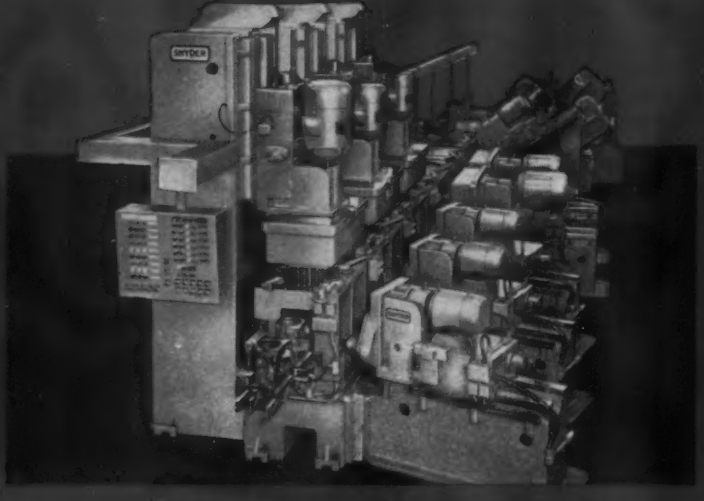
TOOL & ENGINEERING COMPANY
3400 E. LAFAYETTE, DETROIT 7, MICHIGAN

30 Years of Successful Cooperation with Leading American Industries

SEGMENT 1: 40 feet long, 19 stations, 10 spindles. Part manually loaded, both ends face milled, counterbored, three diameters rough and finish bored and faced, two pads side milled, pump pad face milled, clearance slot milled. Part tilted 90 degrees in processing.

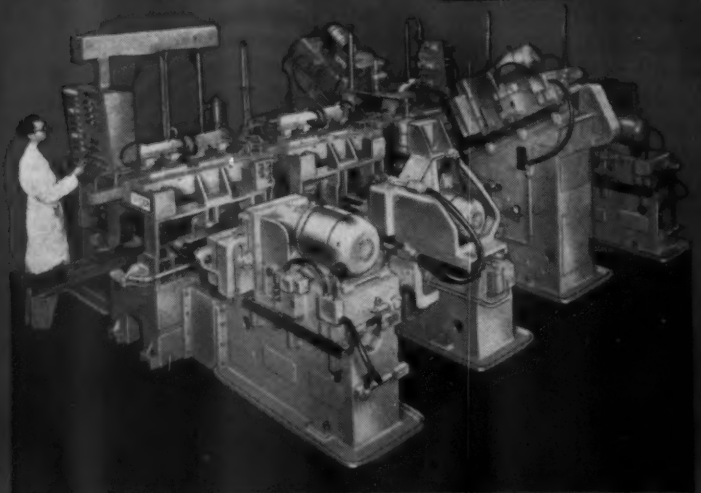


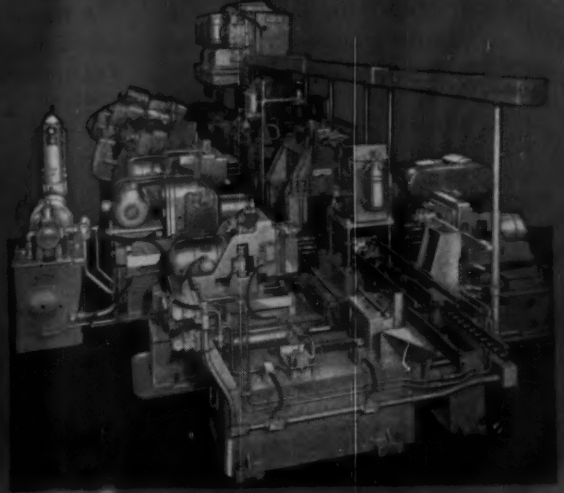
SEGMENT 2: 47 feet long, 31 stations, 91 spindles. In top face, end and at angular locations inside, 51 holes are drilled, countersunk, semi-finish and finish reamed, spotfaced, tapped. Part is tilted 90 degrees and rotated.

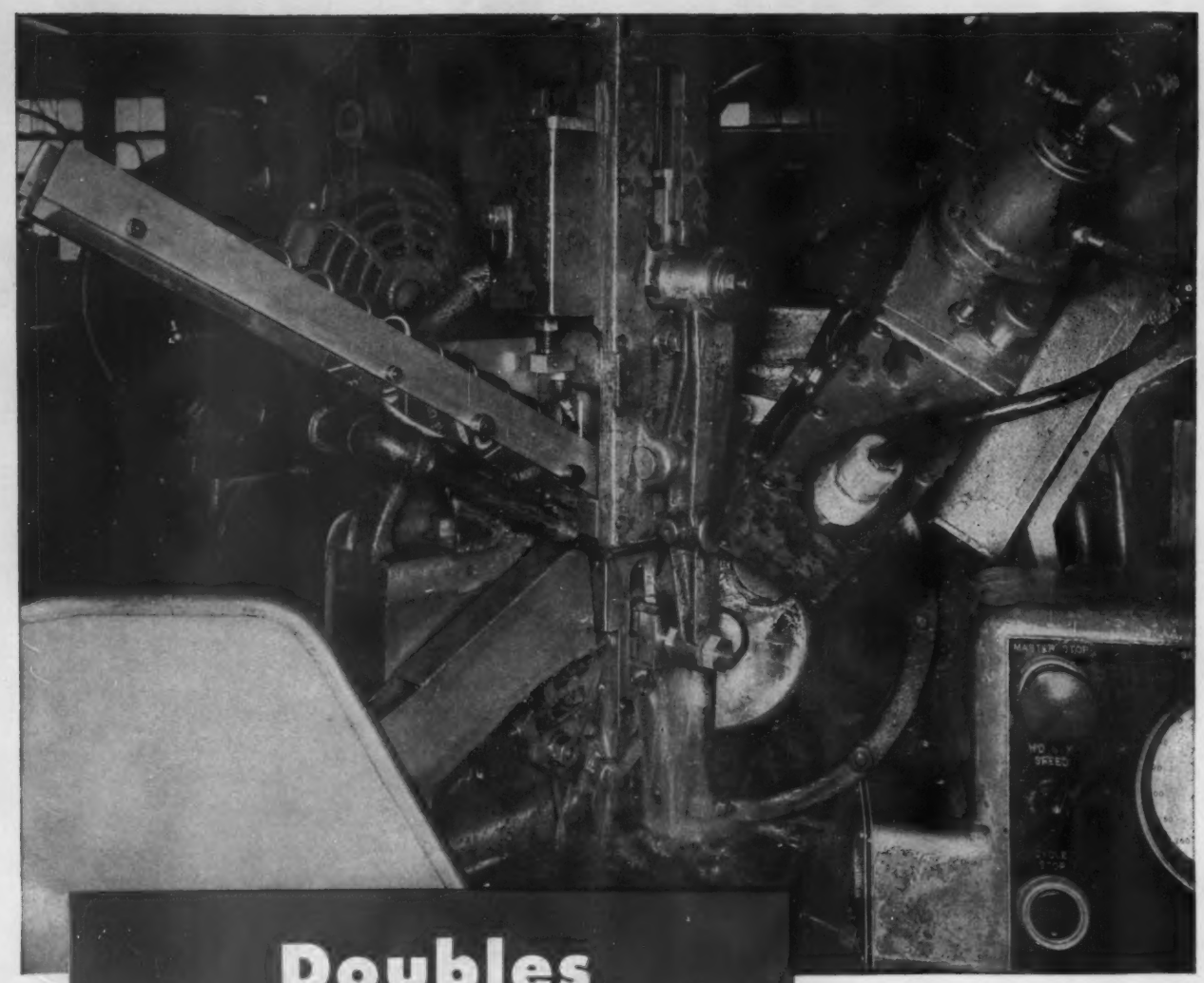


SEGMENT 3: 26 feet long, 17 stations, 21 spindles. Various drilling, chamfering, tapping, counterboring, reaming, spotfacing operations in both case sides. Part removed from transfer bar to special fixture and tipped 45 degrees to process angular inside hole, returned to transfer bar, turned 90 degrees, tilted 90 degrees to bring pump face up.

SEGMENT 4: 36 feet long, 24 stations, 60 spindles. Various drilling, chamfering, tapping, semi-finish boring and facing operations.







Doubles production per wheel dressing

IN GRINDING bearing cones, this manufacturer (name on request) formerly used two different competitive oils—one to lubricate the machine, the other as grinding oil. Contamination of the machine oil by the grinding oil caused bearings to fail after only about three weeks.

A Texaco Lubrication Engineer was called in. He recommended using a dual-purpose oil to serve as both machine lubricant and grinding oil. Machines were changed over to *Texaco Cleartex Oil* and the manufacturer reports no bearing failures for over a year. In addition, he can get as many as twenty pieces (with better finish) per wheel dressing, as against the ten or twelve previously obtained.

There is a complete line of *Texaco Cutting, Grinding and Soluble Oils* to help you do all your machining better, faster and at lower cost. A Texaco Lubrication Engineer will gladly help you select the proper ones.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

☆ ☆ ☆

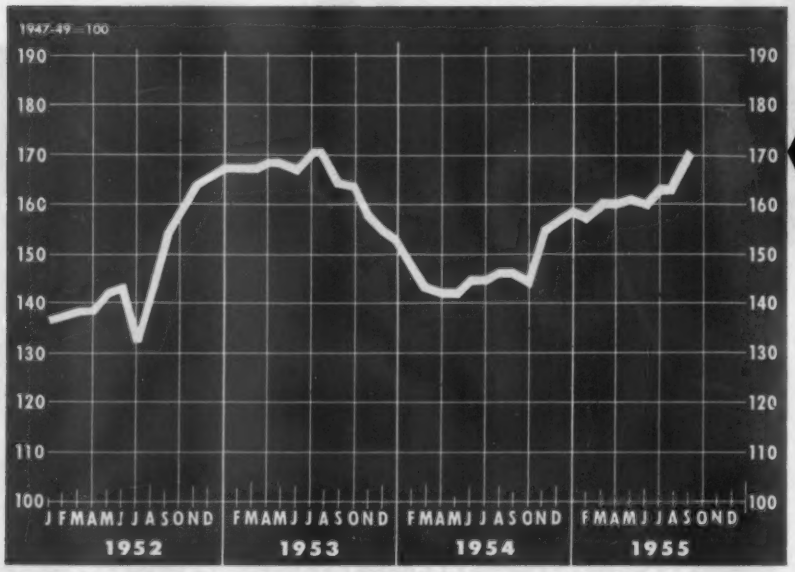
The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

TUNE IN . . . TEXACO STAR THEATER starring JIMMY DURANTE on television . . . Saturday nights, NBC.

Gaging Metalworking . . .



Production Index

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	SEPT. Estimated	AUG. Preliminary	JULY Revised	AUG. Year Ago
Total Idex..	**171**	**170**	**167**	**148**
Machinery	**141**	**138**	**126**	
Electrical Machinery	**202**	**197**	**181**	
Autos	**139**	**155**	**97**	
Other Transportation	**140**	**138**	**126**	
Other Metalworking	**140**	**138**	**126**	

AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

Production continues at peak . . .

The unsettling news about President Eisenhower's health has not put any noticeable damper on metalworking operations.

The pleasant fact is that production this fall is extraordinarily good. And there is nothing on the horizon in the short-term outlook to indicate a dip in activities.

Metalworking is at an all-time peacetime peak, as pointed out on this page two weeks ago. And the likelihood is that it will remain there, or close to it, for some time.

The first quarter of 1956 looks just as good as the remainder of this year.

Users rush to get steel . . .

The rush to get steel is a prime indicator of what kind of business the metalworking industries expect the next six months.

Users are bringing pressure to bear on steel mills to get the latter to accept on a firm basis their orders for first-quarter deliveries.

The tightest situation of all is in flat-rolled steel. Longer and longer deliveries are being quoted. And steel makers are telling customers what items they can get and in what quantities.

The same story holds in copper, except that the supply is farther out of balance with demand than in steel.

Business in non-ferrous metals other than copper is excellent.

Demand soars for industrial supplies . . .

The high degree of metalworking operations is borne out by the gain of 11% in industrial distributors' orders for industrial supplies and machinery.

The August figure of 181.2 on the new order index of the American Supply & Machinery Manufacturers Association is 81% above the base month of July 1948 and has been exceeded only three times in the past two years.

Nowhere is the remarkable strength in the production equipment market better shown than in orders for industrial furnaces and control equipment.

Furnace bookings in August were 144% ahead of the same month of last year. In the first eight months of this year, orders for furnaces and controls were up 77% over 1954, the Industrial Heating Equipment Association reports.

Sales of materials handling equipment also give support to the conclusion that metalworking companies are investing freely in machinery and mechanical devices that cut production costs and speed output.

Materials handling equipment bookings are running 12% better than a year ago, the Material Handling Institute Inc reports.

Auto parts business looking up . . .

Automobile parts makers, facing a heavy demand from Detroit the next 4-5 months, are feeling fine.

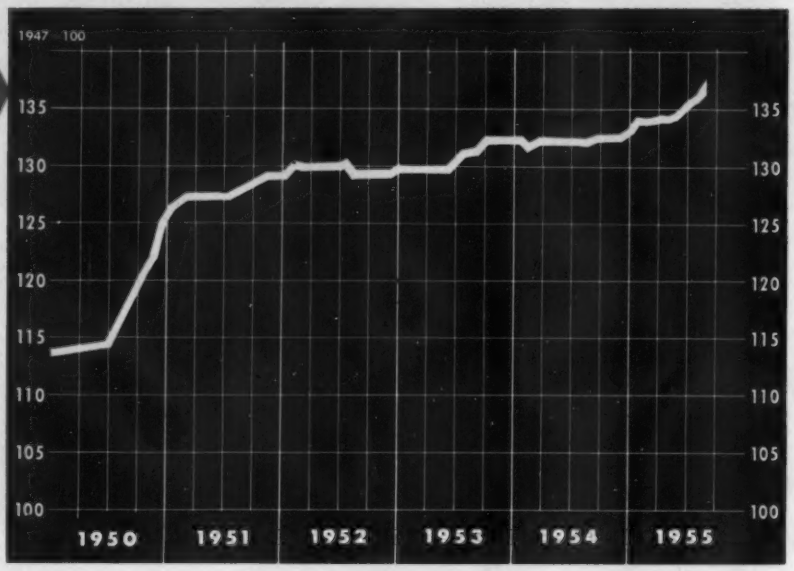
The prospective upsurge in automobile assemblies is having a beneficial effect upon many industries.

The stamping people, for one, are happy about the outlook. But their optimism is tempered by trouble in getting steel. In some cases, they are turning to warehouses for enough fill-in tonnage. And that practice costs extra money.

Gaging Business . . .

Price Index

	SEPT. Estimated	AUG. Preliminary	JULY Revised	AUG. Year Ago
Total Index	**137.5**	**139.9**	**135.8**	**132.6**
Metalworking Machinery		**156.5**	**155.4**	**141.7**
Other Machinery exc. Electrical		**141.9**	**140.3**	**137.4**
Electrical Machinery		**132.8**	**131.9**	**130.9**
Fabricated Metal Products		**132.4**	**131.5**	**129.1**



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

Rise in business is slowing down . . .

Business in general seems to be leveling off a little. This fact antedates President Eisenhower's illness and would have occurred anyway.

The situation is something like this: Industrial activity went up 6 points during the first five months of the year.

Federal Reserve Index of Industrial Production rose only 1 point, however, the past three months.

Mind you, the rise in business has not come to a halt. It is a good guess even now that the FRB index will be around 142 at the end of the year. It is 140 today (1947-1949 = 100).

More capacity needed . . .

It is an interesting and gratifying phenomenon that the nation's business firms are running very close to full capacity.

If demand should go any higher in many industries, more capacity would be needed than now exists.

This is one good reason why so many manufacturers have scaled upward their projected expenditures for new plant and equipment.

Automobiles and housing are the two spots in which weakness has developed in recent weeks.

Cutbacks in car assemblies in August and September helped to reduce stocks of 1955 models in dealers' hands. Dealers had about half a million new cars at the end of September.

Car production is slated to rise sharply before long. General Motors is said to have a terrific production schedule the remainder of this year.

Housing starts are off . . .

Housing starts are definitely down. Fewer starts are forecast for 1956. But houses on the average may be larger. Credit restrictions already have been severely felt by the housing industry.

On the bright side, the number of new families is greater than had been predicted. Family formations this year total 800,000, compared with a forecast of only 500,000.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949 = 100)*	142.2	142.0	121.3
Steel ingot operation (thousands of tons)	2,316	2,320	1,678
Electric power output (million kilowatt hours)	10,756	10,580	9,074
Production of automobiles and trucks	152,171	146,484	71,904
Engineering construction awards (*Eng. News-Record*—millions)	$260.0	$432.0	$233.9

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949 = 100)*	140	139	123
Index of durable manufactures production (1947-1949 = 100)*	158	155	135
Durable goods manufacturers' sales, millions*	$13,533	$13,527	$11,153
Machinery manufacturers' sales, millions*	$ 3,514	$ 3,547	$ 3,151
Durable goods manufacturers' new orders, millions	$13,440	$14,033	$ 9,407
Machinery manufacturers' new orders, millions	$ 3,635	$ 3,734	$ 2,579

*Seasonally adjusted

Automate for top performance with . . .

T-J Spacemaker CYLINDERS

CIRCULAR HEADS WITH TIE RODS
SQUARE HEADS WITH TIE RODS
40% SPACE SAVED
T-J
T-J
T-J
T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

Style SM5 shown

- The Only Cylinders with all the Extras as Standard
- Oil pressure to 750—AIR to 200 P.S.I.
- New Compact Design . . . Saves up to 40% Space
- Proven Performance . . . with Extra High Safety Factor
- Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Oil Cushion
- Hard Chrome Plated Bodies and Piston Rods (Standard)
- Only from T-J can you get these new ingenious cushion designs

More and more of industry's automation problems today—solved with T-J Spacemaker Cylinders! New compact design and many more plus features for a new high in efficient cylinder performance and dependability. Wide range of styles, capacities . . . to help you *save labor, reduce costs* on all kinds of push-pull-lift jobs. Send for bulletin SM-155-1. The Tomkins-Johnson Co., Jackson, Mich.

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RIVITORS . . . AIR AND HYDRAULIC CYLINDERS . . . CUTTERS . . . CLINCHORS

Where to Get
ARMCO STAINLESS STEELS
in a Hurry

When you need quick delivery of stainless steel bars and wire, remember this: An Armco Distributor's warehouse is close-by. A phone call is all that's required.

You'll find that Armco Stainless Distributors know their business. All have mill-trained salesmen who will be glad to work with you in selecting the right grade. They have the latest Armco literature and fabricating information. It's available to you for the asking.

Look over this list of Armco Stainless Steel Distributors. There's probably one in your own "back yard." Keep him in mind the next time you need stainless.

Armco Stainless Steel Bar and Wire Distributors

ARIZONA
Phoenix
Ducommun Metals & Supply Co.

CALIFORNIA
Berkeley
Ducommun Metals & Supply Co.
Los Angeles
The Cold Metal Products Co. of California
Ducommun Metals & Supply Co.
San Diego
Ducommun Metals & Supply Co.
San Francisco
Electric Steel Foundry Co.

COLORADO
Denver
Metal Goods Corp.

CONNECTICUT
Hartford
The American Steel & Aluminum Corp.
Peter A. Frasse & Co., Inc.

GEORGIA
Atlanta
J. M. Tull Metal & Supply Co.

ILLINOIS
Chicago
Central Steel & Wire Co.
Chicago Steel Service Co.

KANSAS
Wichita
Metal Goods Corp.

LOUISIANA
New Orleans
Metal Goods Corp.

MAINE
Auburn
Brown-Wales Co.

MARYLAND
Baltimore
Seaboard Steel & Iron Corp.

MASSACHUSETTS
Cambridge
Brown-Wales Co.
Industrial Steels, Inc.
Fall River
Congdon & Carpenter Co.

MICHIGAN
Detroit
Central Steel & Wire Co.

MISSOURI
North Kansas City
Metal Goods Corp.
St. Louis
Metal Goods Corp.

NEW YORK
Buffalo
Peter A. Frasse & Co., Inc.
Rochester
Follansbee Metals Corp.
Syracuse
Peter A. Frasse & Co., Inc.

METROPOLITAN NEW YORK
New York City
Peter A. Frasse & Co., Inc.

METROPOLITAN NEW YORK, Contd.
Hillside, N. J.
Edgcomb Steel & Aluminum Corp.
Lyndhurst, N. J.
Peter A. Frasse & Co., Inc.
Union, N. J.
Mapes & Sprowl Steel Co.

NORTH CAROLINA
Charlotte
Edgcomb Steel Co.

OHIO
Cincinnati
Central Steel & Wire Co.
Cleveland
Cleveland Tool & Supply Co.
Viking Steel Co.
Columbus
Vorys Brothers, Inc.

OKLAHOMA
Tulsa
Metal Goods Corp.

OREGON
Portland
Electric Steel Foundry Co.

PENNSYLVANIA
Philadelphia
Edgcomb Steel Co.
Peter A. Frasse & Co., Inc.
Pittsburgh
Follansbee Metals Corp.

PENNSYLVANIA, contd.
York
Edgcomb Steel Co.

RHODE ISLAND
Providence
Congdon & Carpenter Co.

TENNESSEE
Memphis
Metal Goods Corp.

TEXAS
Dallas
Metal Goods Corp.
Houston
Metal Goods Corp.

WASHINGTON
Seattle
Electric Steel Foundry Co.
Spokane
Electric Steel Foundry Co.

WISCONSIN
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Central Steel & Wire Co.

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Montreal, Quebec
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American Machinist

MAGAZINE OF METALWORKING PRODUCTION * ESTABLISHED 1877

As Congress Looks Into Automation

That magic word automation and all that it is supposed to stand for is to be the subject of a Congressional committee hearing this month. The hearing has been assiduously promoted by CIO president Walter Reuther.

The idea back of the hearing is that automation gives promise of being a frightening development, with dire consequences for the American people, unless it is closely controlled. We had better begin now, before it is too late, to figure out ways and means of softening its impact.

You would think, from reading the newspapers, that automation had suddenly burst upon us without warning. The fact is that only the word is new. And even it has been mentioned in print for the past seven years.

Automation is a convenient word for something that has been around a long time — the mechanization and automatic control of manufacturing processes. Oil refineries, chemical plants, glass-making factories and continuous steel rolling mills are prime examples of automatic production. They require lots of machinery and relatively few men.

Automobile plants, chief source of revenue to Mr Reuther's automobile union, provide perhaps the most spectacular applications of automation. Even so, automation is making good headway in manufacture of metal goods other than motor cars.

But let's not blow up automation into something that it isn't. We are not yet in the pushbutton age when robots have completely taken over from men. The nation's metalworking industries derive inestimable strength from thousands of small plants in which mechanization can be used profitably only within certain bounds. They are essentially job shops which cannot take advantage of mass-production techniques.

Let's not, on the other hand, play down automation. Mechanization of industry will continue to progress. And from here on it is more likely to pick up speed than to slow down.

It will pick up speed because Mr Reuther and all the other union leaders press management relentlessly for higher wages and greater benefits for their members. To meet these ever-mounting labor costs, industry must see that each man produces more without working harder. More mechanization is the only way to achieve greater production per man.

The score then is about like this: More production per man results in more purchasing power per man. More purchasing power per man spells a bigger demand for goods. A bigger demand for goods keeps factories busy and people employed.

Sounds fine, you say. But how many men does automation knock out of jobs? The fact is that there is little to support the theory, which Mr Reuther and his followers view with great alarm, that automation may produce vast unemployment.

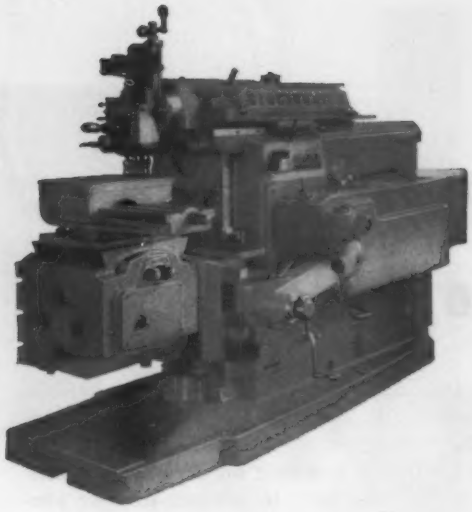
Machine power, to be sure, directly displaces manpower on specific jobs. **There is lots of evidence, however, that the ever-widening use of machines lowers costs, broadens markets and creates new demands for goods and services that in turn draw upon the nation's manpower in surprising numbers.**

Automation in itself has spawned many new industries engaged in producing automatic machinery and an impressive array of accessories thereto. Further, automation is rapidly expanding the necessity for more and more skilled maintenance crews to keep the machines running.

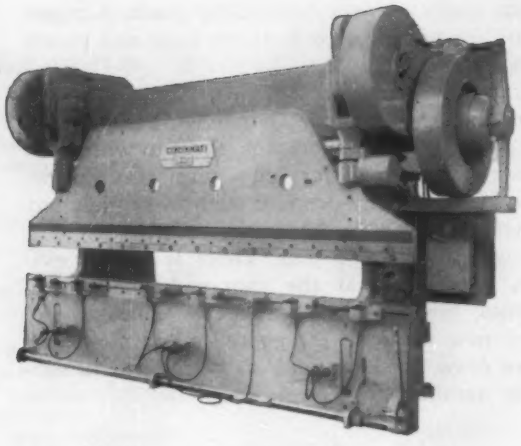
Let's not forget another point. For many years ahead, the population of our country will grow at a much faster rate than the work force. Only by more extensive use of mechanization can we hope to keep up with the demands of the people for goods and services.

On second thought, perhaps the airing of automation and its implications before a Congressional committee is a good thing. It is a good thing, that is, as long as the solid facts are brought out and the hearing is kept free from propaganda on behalf of pet projects.

Burnham Finney



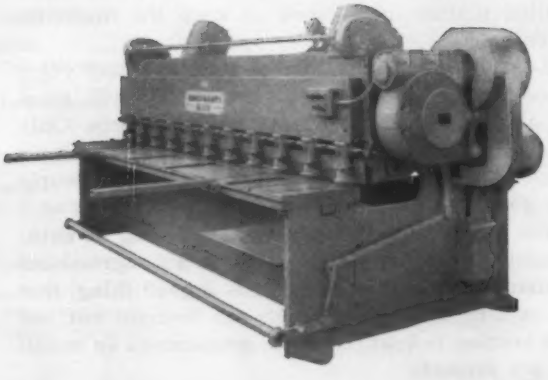
Important Announcement to the Metal Working Industry



The Cincinnati Shaper Company

announces a

5 Year Guarantee



on material and workmanship on all new machines shipped after September 1, 1955. This guarantee is evidence of the unusual dependability of our machines.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

American Machinist

14 steps TO DESIGN A DIE

J. R. PAQUIN

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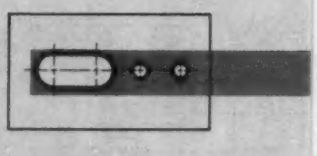
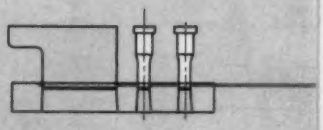
1 **First step in designing any di**
appear at the bottom of the p
proper distance between views,
grows. Always use red lead wh
clearly through the maze of b
make a perspective, too, to help

Haphazard die-design methods often result in inefficient press tools, but systematic procedures will provide:

1. Consistently good designs
2. Speedy, effortless work
3. Far fewer erasures
4. Improved appearance of drawings
5. Stronger punch and die components

Here are illustrated the 14 steps required to design a die for making pierced links. By appropriate substitutions, the same steps can be used in design of any type of die. For example, if a spring stripper must be used, it replaces the solid stripper shown at Step 10.





4 **Piercing punches are now dra**
views in the upper right-hand
punches and blanking punch is
finished die will appear as if o

American Machinist

14 steps TO DESIGN A DIE

J R PAQUIN

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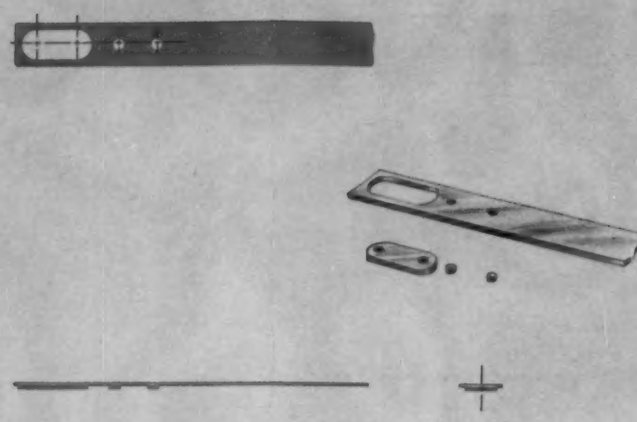

1 **First step in designing any die** is to lay out the material strip *exactly* appear at the bottom of the press stroke. Three views are shown. Estima proper distance between views, to prevent them running into each other grows. Always use red lead when drawing the material strip, so that it clearly through the maze of black lines representing punch and die po make a perspective, too, to help visualization

Haphazard die-design methods often result in inefficient press tools, but systematic procedures will provide:

1. Consistently good designs
2. Speedy, effortless work
3. Far fewer erasures
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5. Stronger punch and die components

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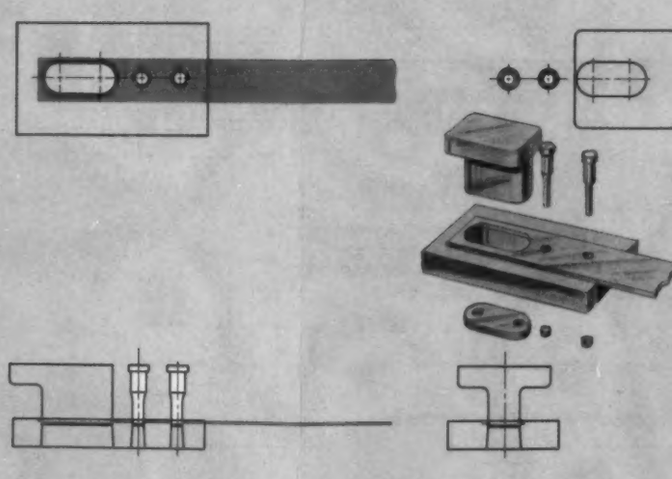
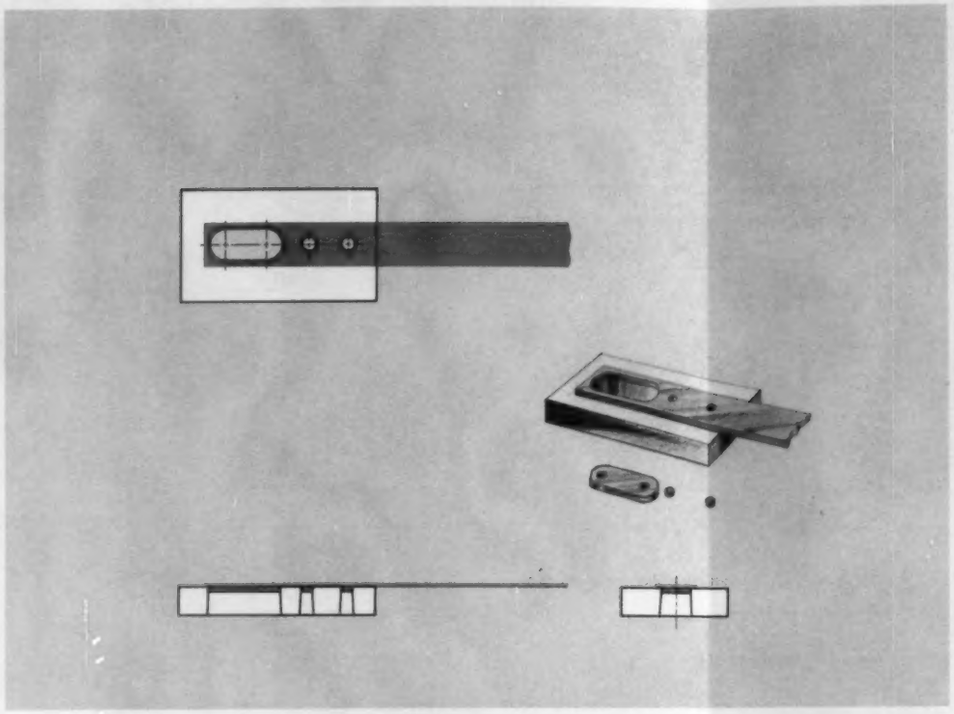
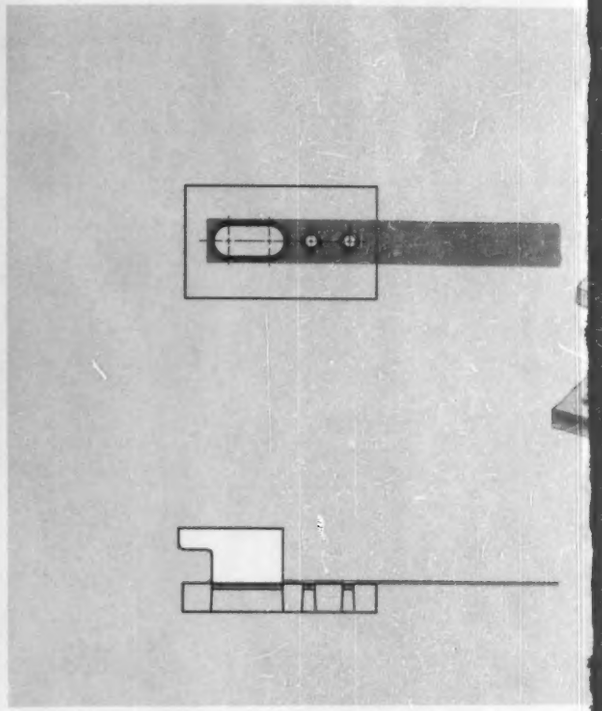


4 **Piercing punches are now drawn in their proper positions.** Include the views in the upper right-hand corner, remembering that this view of th punches and blanking punch is opposite from the plan view of the die bl finished die will appear as if opened much in the same manner as a book

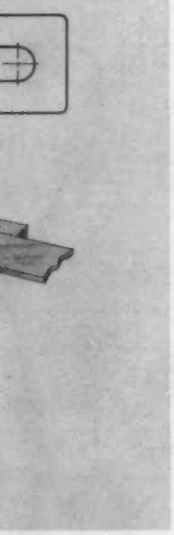
xactly as it will
Estimate the
other as the die
hat it will show
die parts. Always



2 **Draw the three views of the die block.** Leave sufficient room for the screws and dowels which will fasten it to the die set. The perspective now shows the die block in position under the strip. (For publishing convenience, the perspectives are less than full-scale and brought in close to the layout, but the designer might well use the same scale for them as for the die drawing)



3 **The blanking punch is now drawn in position,**
upper right-hand corner. When outlining the flan
consideration the screws and dowels which will
Improve your ability to visualize the die in three
the blanking punch above the blank opening in the



ude their plan
w of the piercing
die block. The
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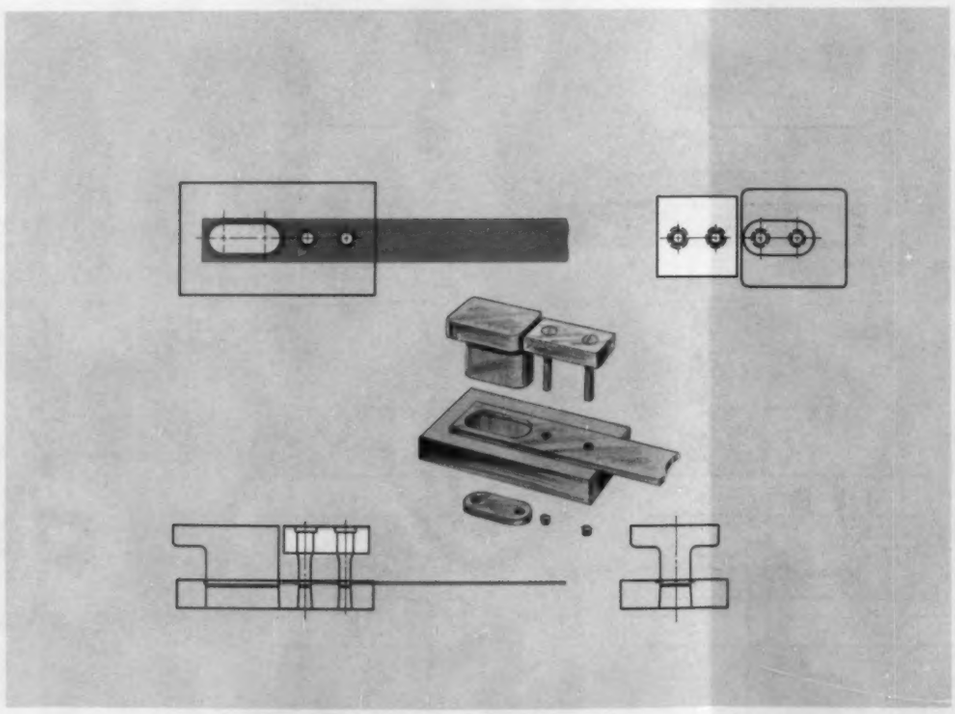
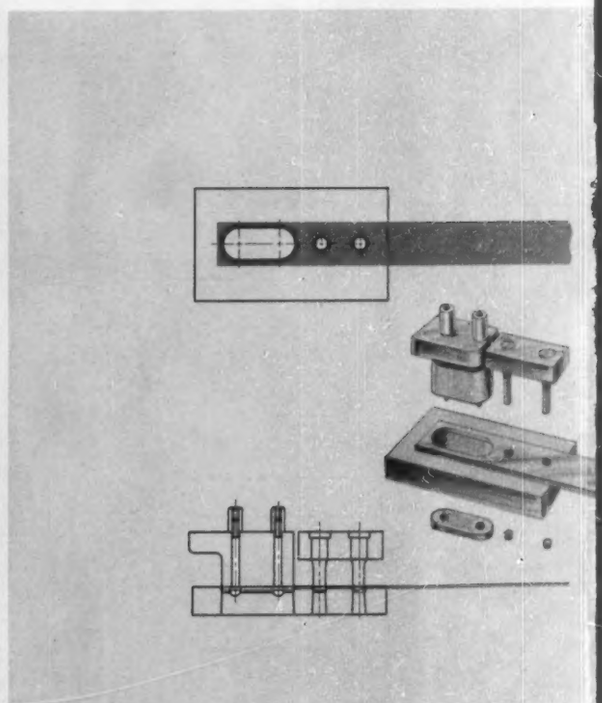


5 **In this step, the punch block,** which retains the piercing punches, is drawn in. The block is usually made of a good grade of machine steel. Here again, room must be allowed for the screws and dowels which will secure it to the punch holder of the die set



6 **Insert the pilots** that will accurately locate the
in the blanking punch. Only outlines of the parts
drawn until the design is completed

American Machinist • October 10, 1955 129-134

American Machinist

14 steps TO DESIGN A DIE

J R PAQUIN

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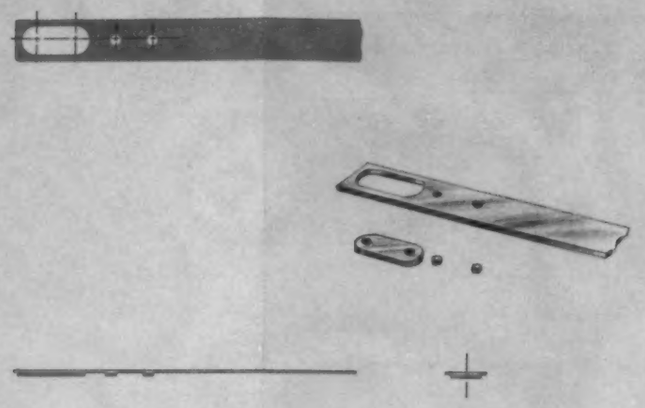
phazard die-design methods often
lt in inefficient press tools, but
ematic procedures will provide:
. Consistently good designs
. Speedy, effortless work
. Far fewer erasures
. Improved appearance of drawings
. Stronger punch and die components
ere are illustrated the 14 steps required to
gn a die for making pierced links.
ppropriate substitutions, the same steps
be used in design of any type of die.
example, if a spring stripper must be used,
places the solid stripper shown at Step 10.



1 **First step in designing any die** is to lay out the material strip *exactly* as it will appear at the bottom of the press stroke. Three views are shown. Estimate the proper distance between views, to prevent them running into each other as the die grows. Always use red lead when drawing the material strip, so that it will show clearly through the maze of black lines representing punch and die parts. Always make a perspective, too, to help visualization

2 **Draw th**
dowels
in positi
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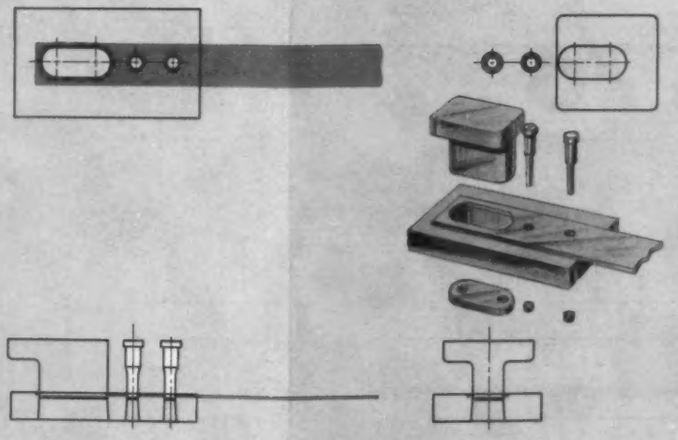
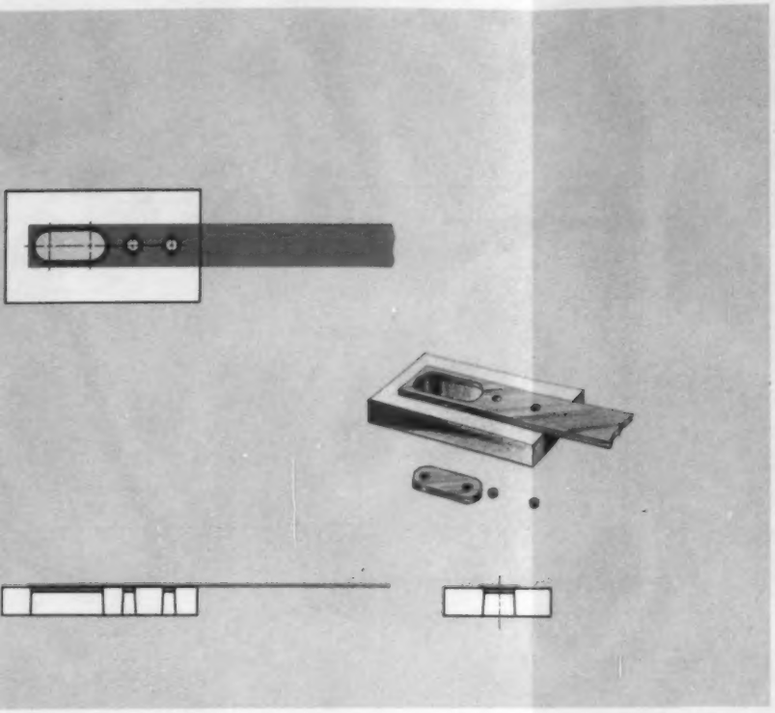
the same

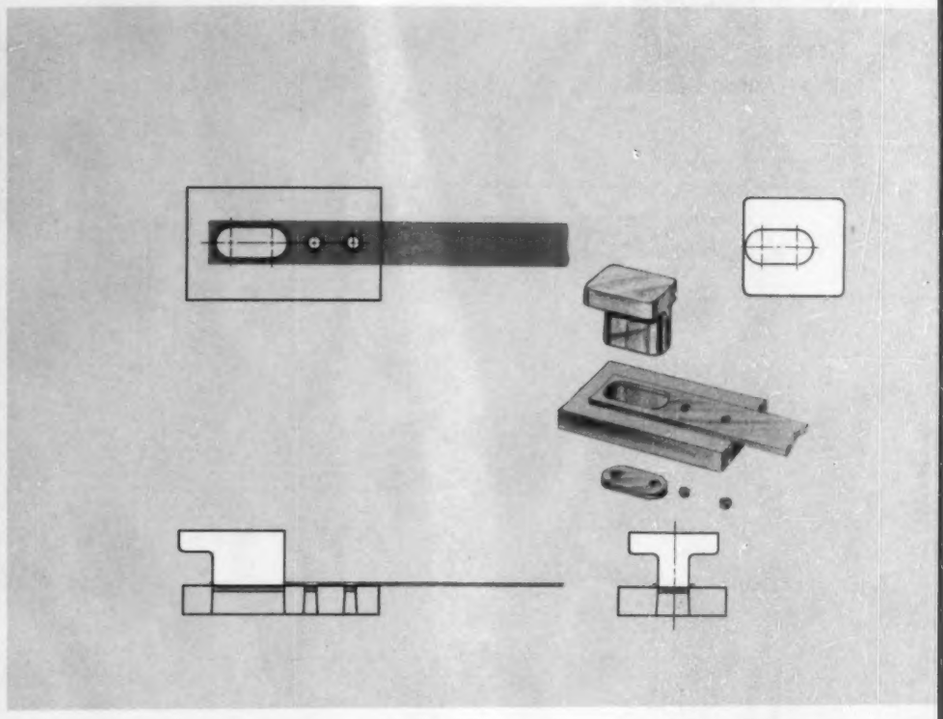


4 **Piercing punches are now drawn in their proper positions.** Include their plan views in the upper right-hand corner, remembering that this view of the piercing punches and blanking punch is opposite from the plan view of the die block. The finished die will appear as if opened much in the same manner as a book is opened

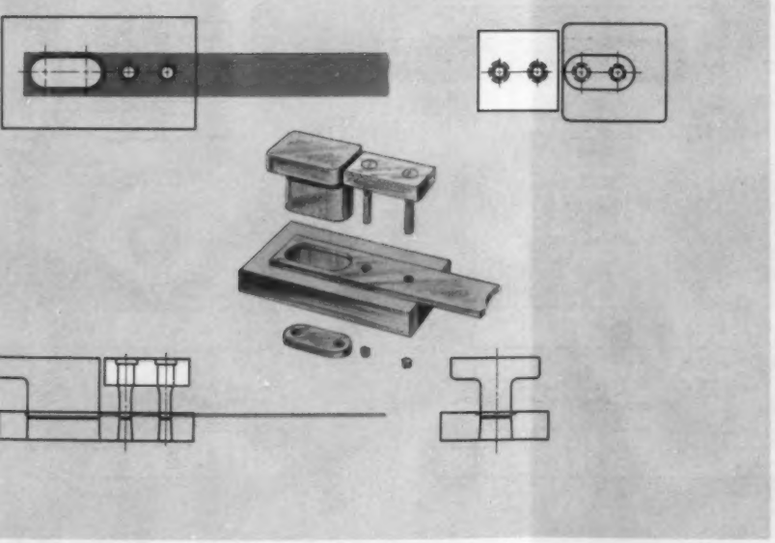
5 **In this st**
The block
be allow
of the die



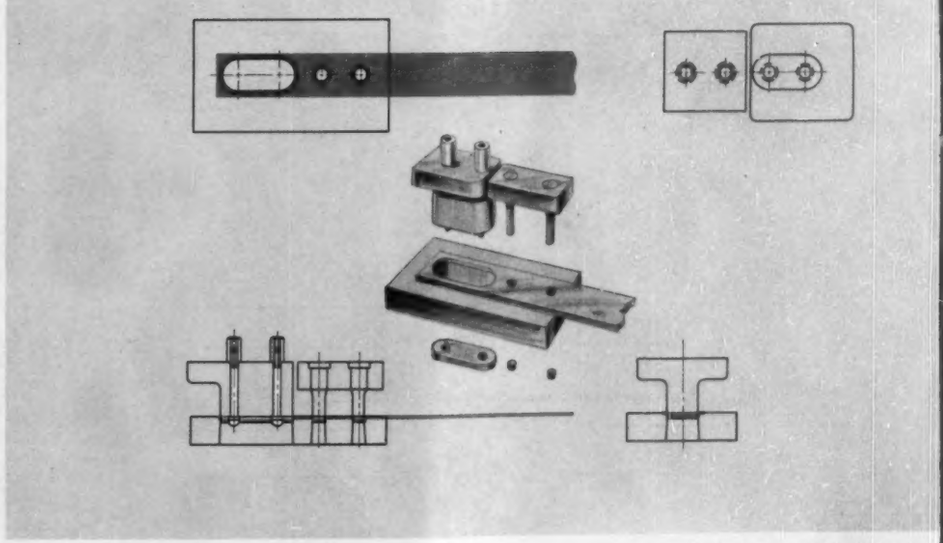
raw the three views of the die block, Leave sufficient room for the screws and owels which will fasten it to the die set. The perspective now shows the die block position under the strip. (For publishing convenience, the perspectives are less han full-scale and brought in close to the layout, but the designer might well use he same scale for them as for the die drawing)



3 **The blanking punch is now drawn in position,** its plan view being placed in the upper right-hand corner. When outlining the flange width and thickness, take into consideration the screws and dowels which will fasten it to the punch holder. Improve your ability to visualize the die in three dimensions by making a sketch of the blanking punch above the blank opening in the die block

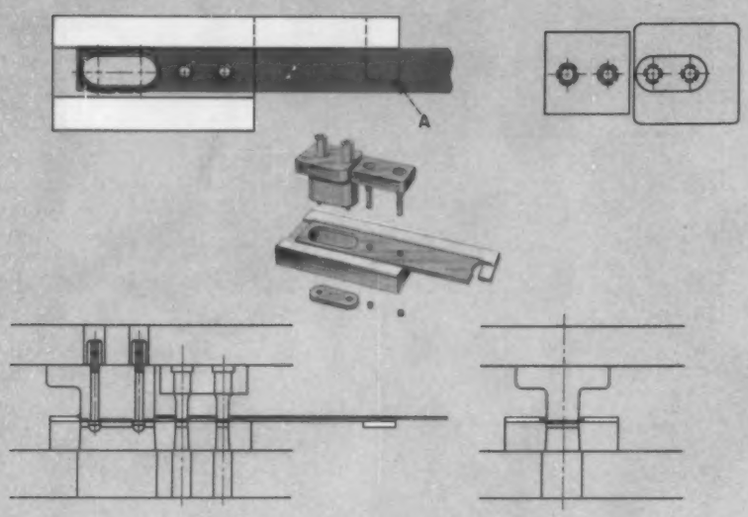


this step, the punch block, which retains the piercing punches, is drawn in. he block is usually made of a good grade of machine steel. Here again, room must allowed for the screws and dowels which will secure it to the punch holder the die set

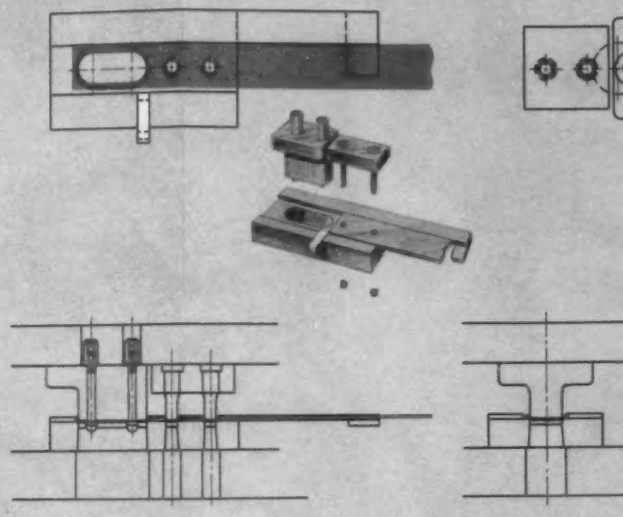


6 **Insert the pilots** that will accurately locate the strip, and the nuts that hold them in the blanking punch. Only outlines of the parts are used. Section lines are never drawn until the design is completed

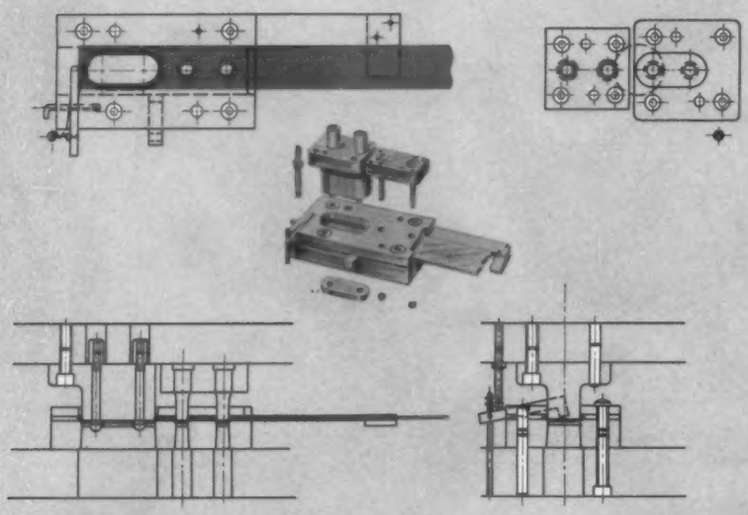
14 steps TO DESIGN A DIE



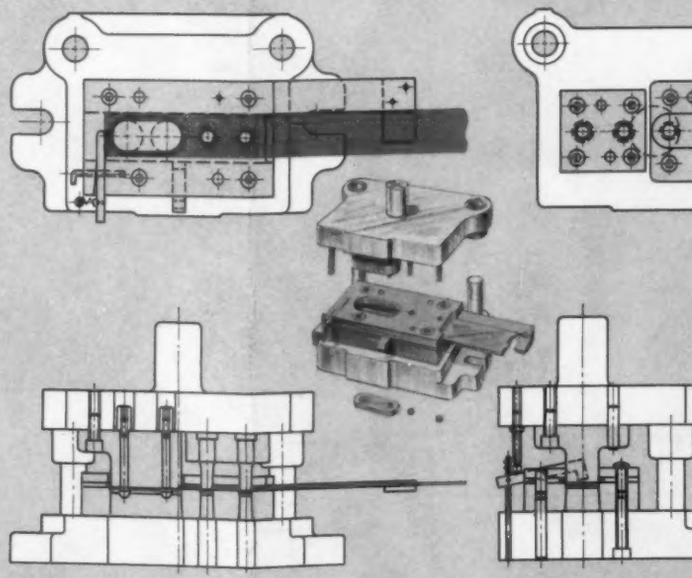
7 **Until now, the strip has not been located;** it simply lies on top of the die block. So, we now apply the back gage and front spacer, which guide the strip at its sides. Strip support *A*, if one is used, can be drawn in at this time



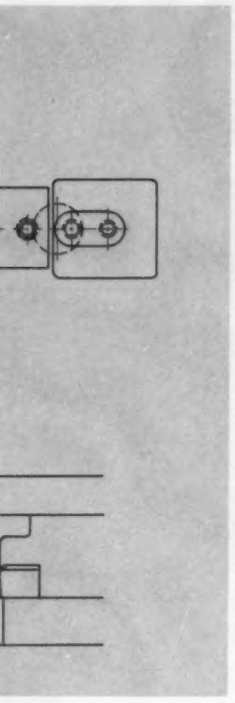
8 **Although the strip is now supported sideways,** no provision has endwise location. So, draw a finger stop, which initially stops the strip the two holes in the first blank. At this point the punch shank is repre upper right-hand view by a dotted circle. It should be so placed that hole will be entirely within, or completely outside of, it



11 **In this step, all screws and dowels are shown.** For press tools all dowels are the same diameter as the screws for any particularly member. Note that the relatively new button-head socket screws are used to fasten the solid stripper to the die block. Because of their low head weight, strength and clean lines, these are excellent fasteners for this application



12 **The die set,** which was started as four horizontal lines in the lower vi now completed. To draw in the die set before this step will almost result in considerable erasing when die sections are found to be too s sizes are increased



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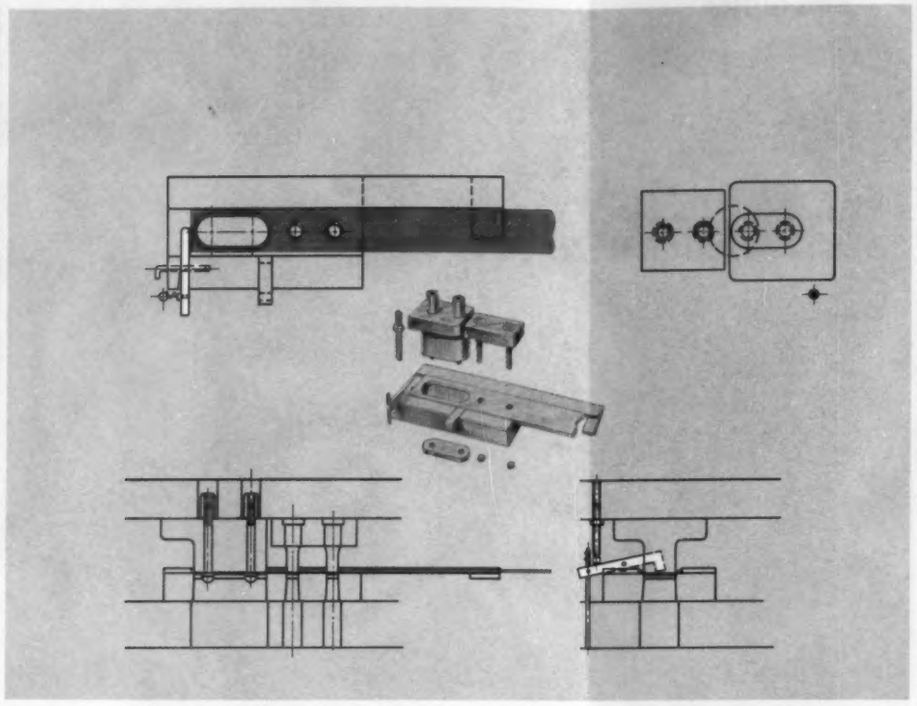
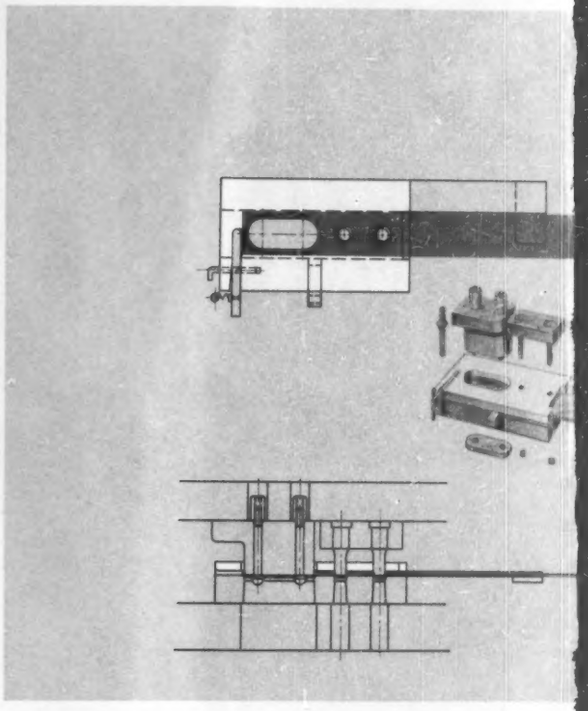
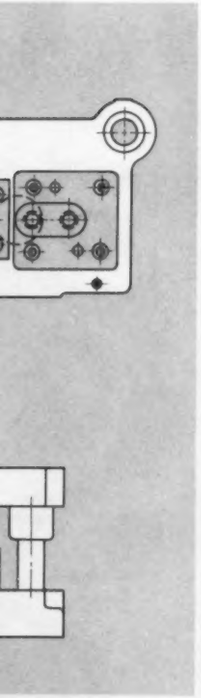


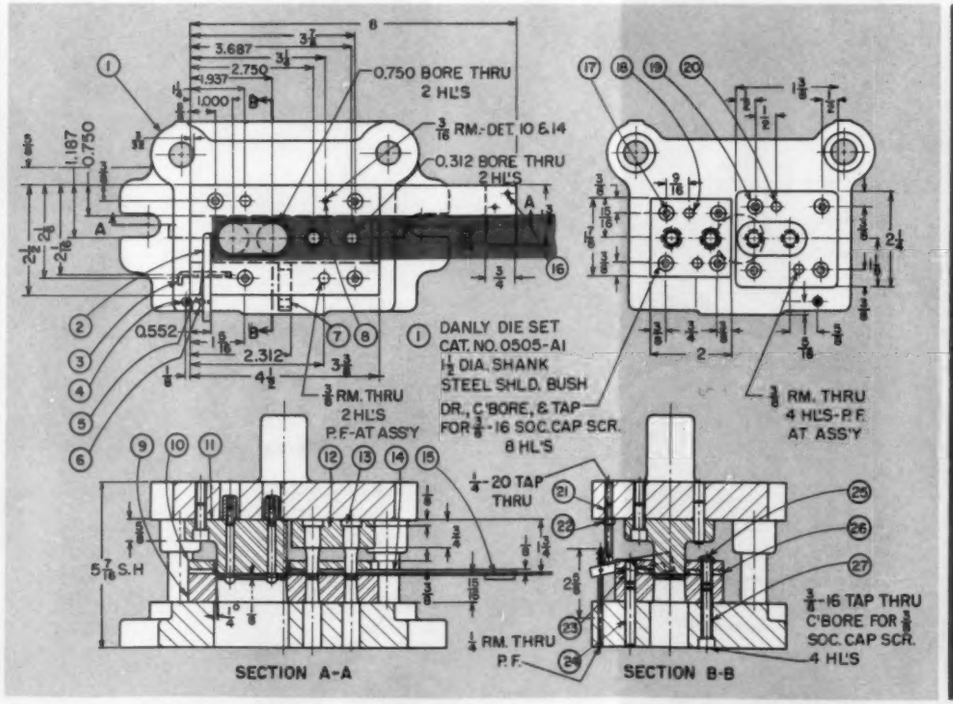
9 **An automatic stop,** which locates the end of the strip at every punch stroke, is now drawn. All lines, so far, have been made very light for easy erasure when sizes of components are altered. There are numerous types of automatic stops, but the one illustrated is perhaps the most widely used



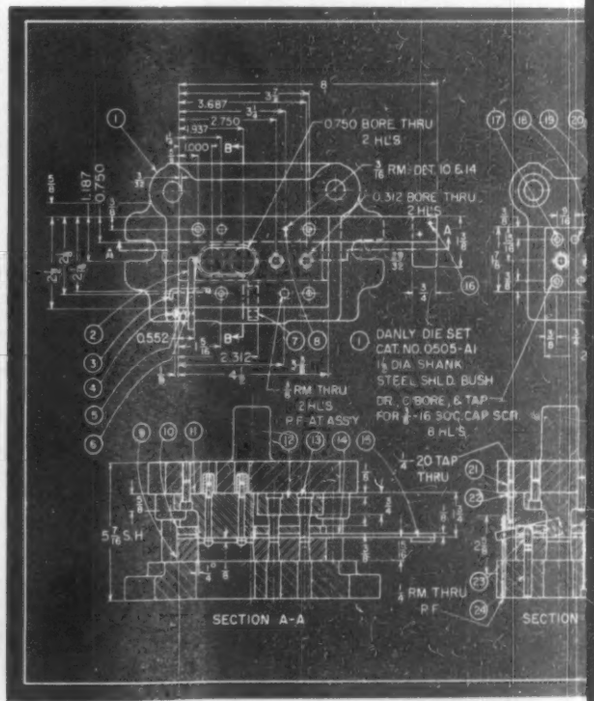
10 **The solid stripper,** which removes the strip from ar
punches, is now applied to all three views. In the up
die block, all lines under the solid stripper now become



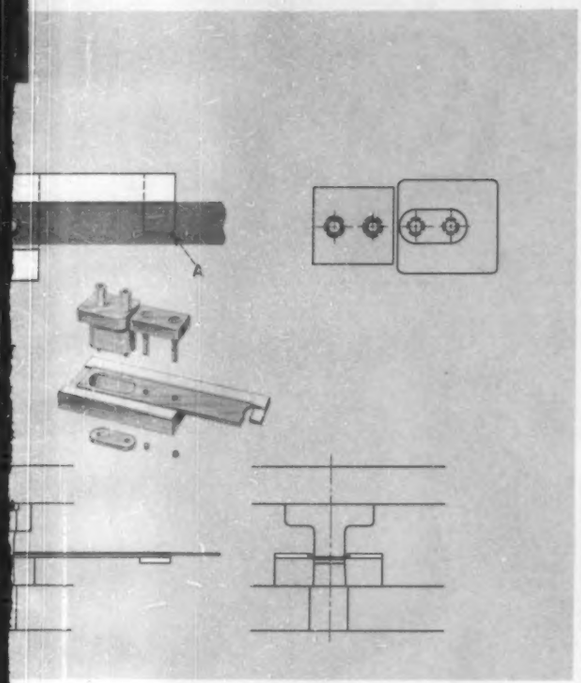
wer views of Step 7, is
almost invariably
too small and their



13 **All dimensions and notes are printed.** Die-block dimensions are applied as for a jig-borer layout. All information that the die maker might require should now be on the drawing



14 **Final step in designing this die** is to fill in the b
sheets are used, the border is applied, the paper is
is complete



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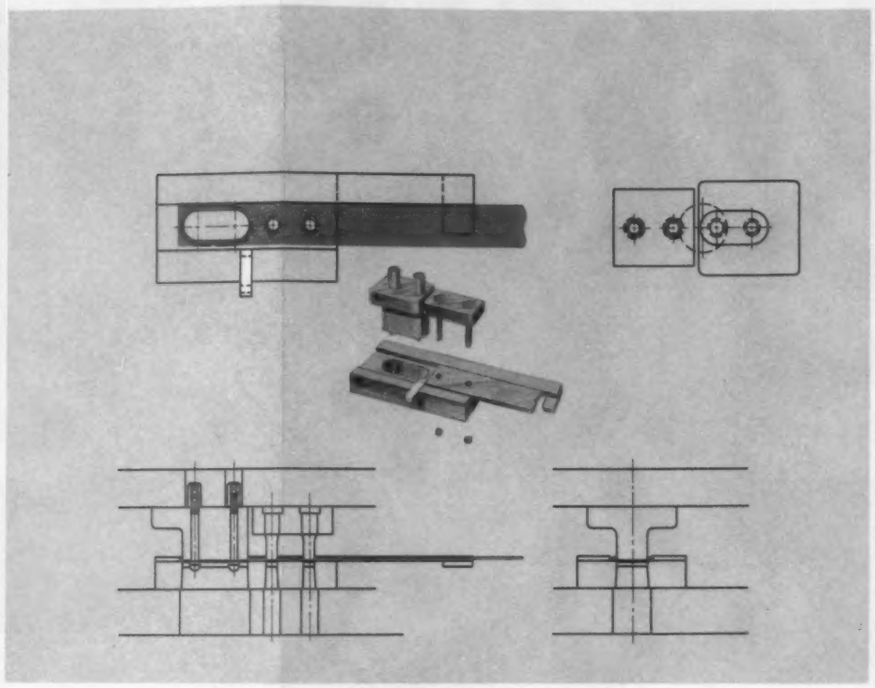
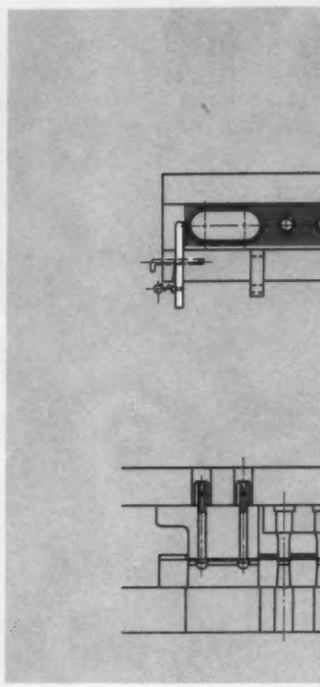
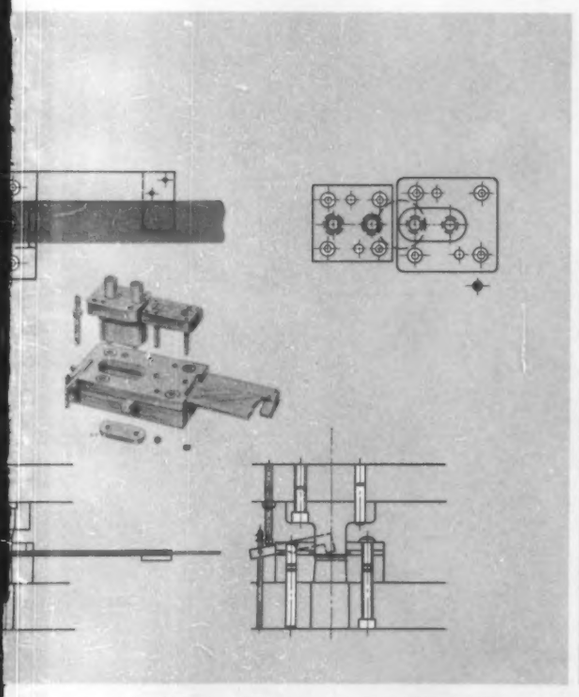


8 **Although the strip is now supported sideways,** no provision has been made for endwise location. So, draw a finger stop, which initially stops the strip for piercing the two holes in the first blank. At this point the punch shank is represented in the upper right-hand view by a dotted circle. It should be so placed that any clearance hole will be entirely within, or completely outside of, it



9 **An automatic stop,** drawn. All lines, so far components are altered illustrated is perhaps th



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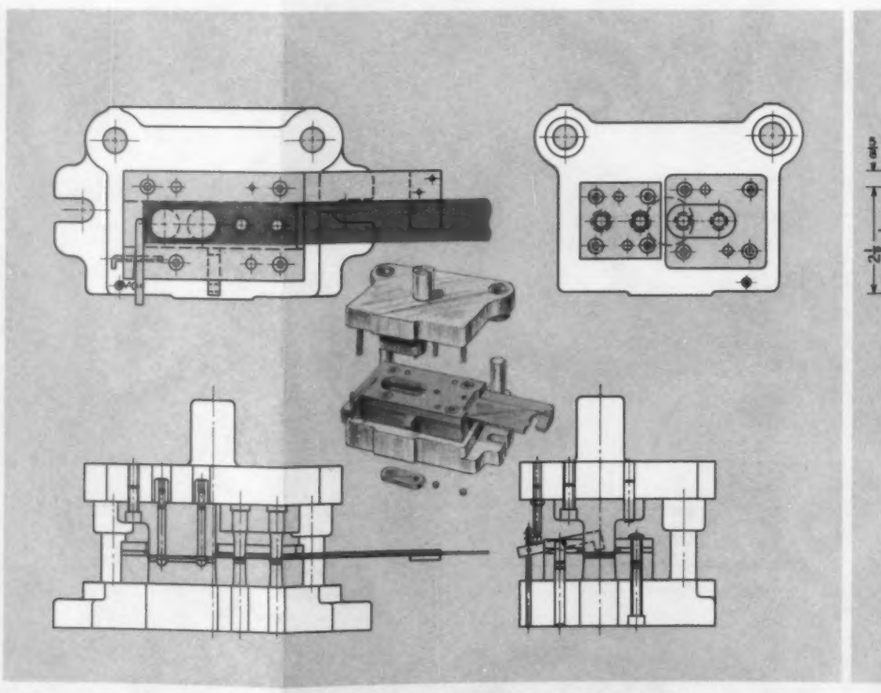
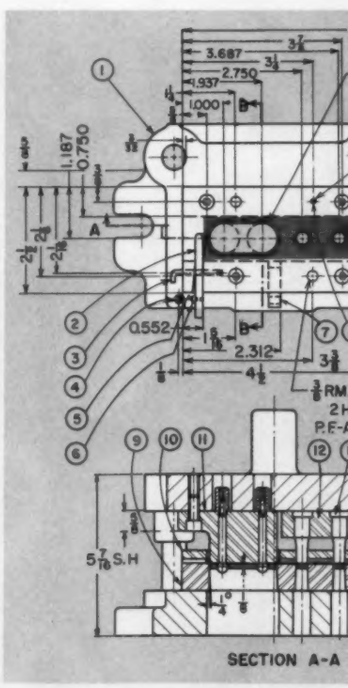
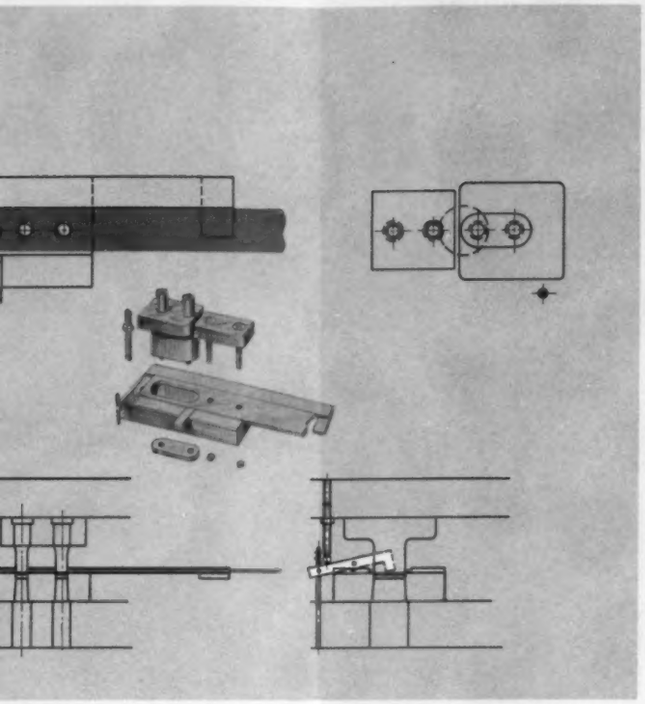


12 **The die set,** which was started as four horizontal lines in the lower views of Step 7, is now completed. To draw in the die set before this step will almost invariably result in considerable erasing when die sections are found to be too small and their sizes are increased



13 **All dimensions and n** jig-borer layout. All i on the drawing



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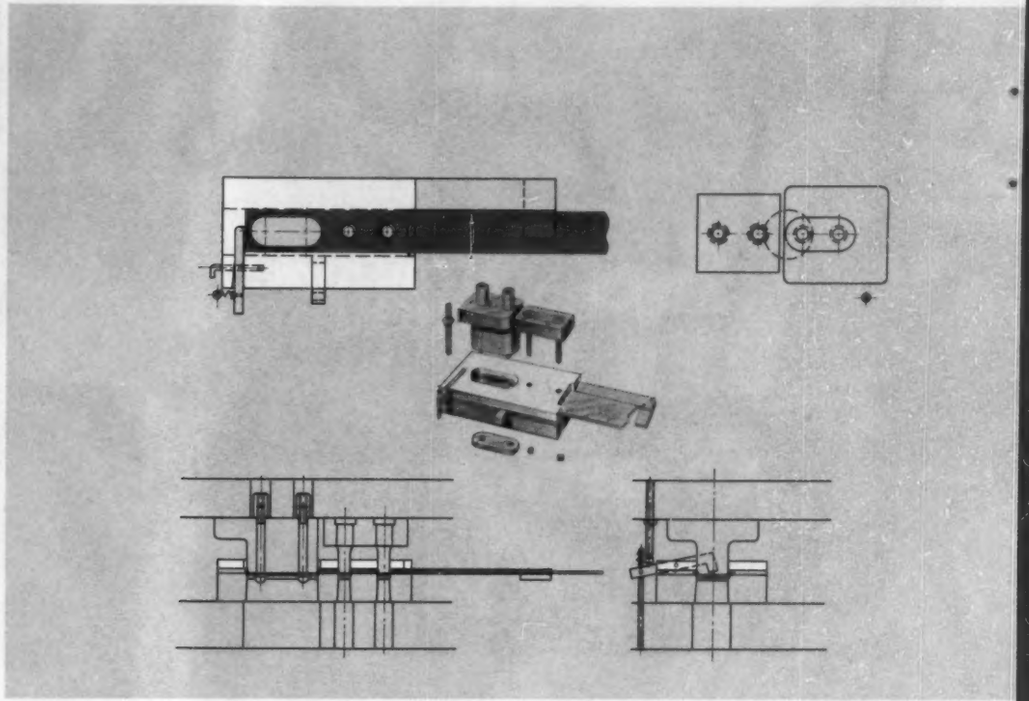
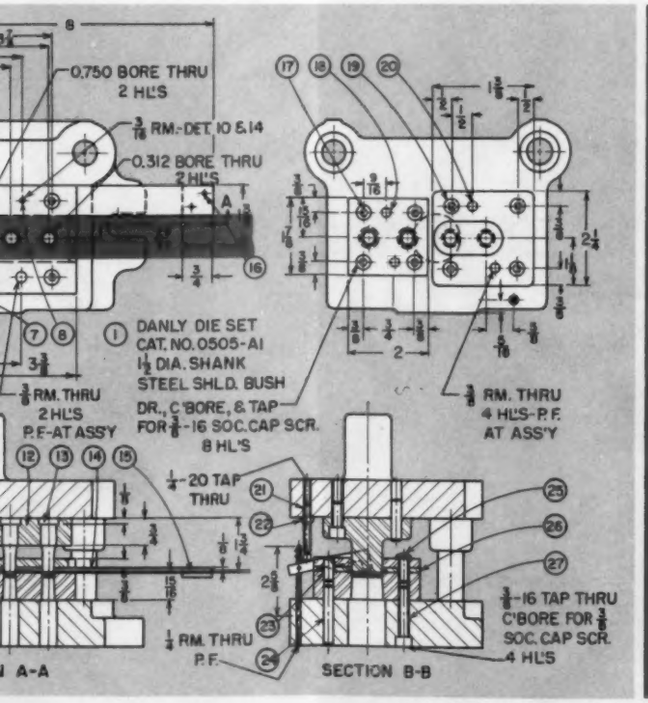


10 **The solid stripper,** which removes the strip from around the blanking and piercing punches, is now applied to all three views. In the upper-left plan view of the die block, all lines under the solid stripper now become dotted


0.750 BORE THRU 2 HL'S
RM.-DET. 10 & 14
0.312 BORE THRU 2 HL'S
DANLY DIE SET CAT. NO. 0505-AI
1½ DIA. SHANK STEEL SHLD. BUSH
DR., C'BORE, & TAP FOR ⅜-16 SOC. CAP SCR. 8 HL'S
⅜ RM. THRU 2 HL'S P.F. AT ASS'Y
⅜ RM. THRU 4 HL'S-P.F. AT ASS'Y
¼-20 TAP THRU
⅜-16 TAP THRU C'BORE FOR ⅜ SOC. CAP SCR. 4 HL'S
¼ RM. THRU P.F.
SECTION B-B

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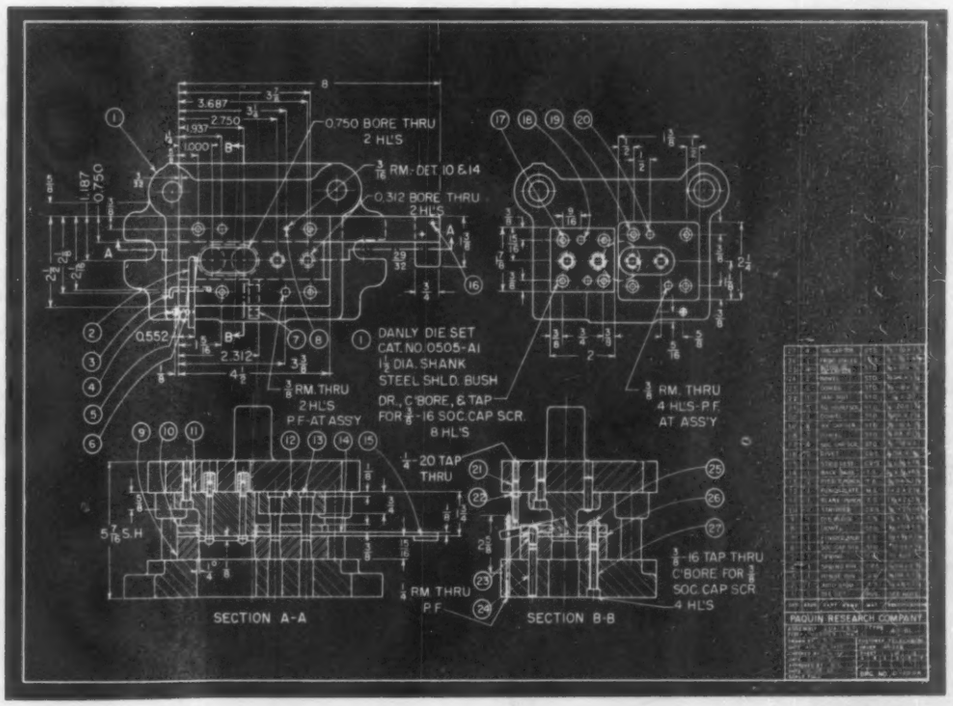
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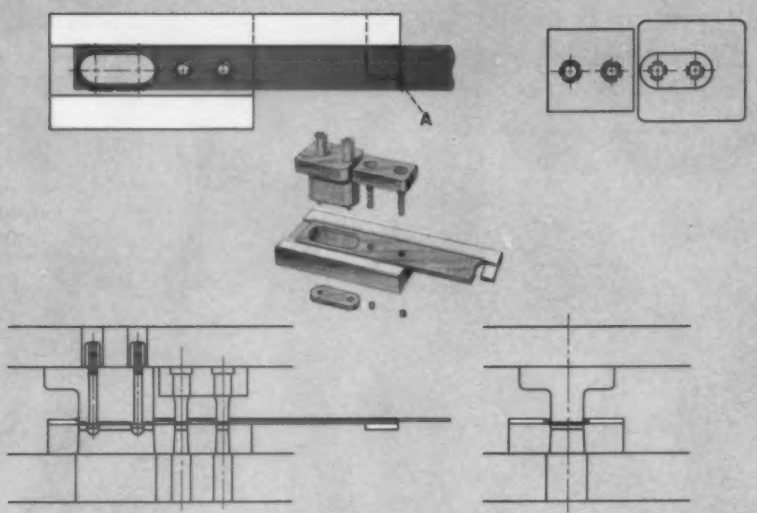
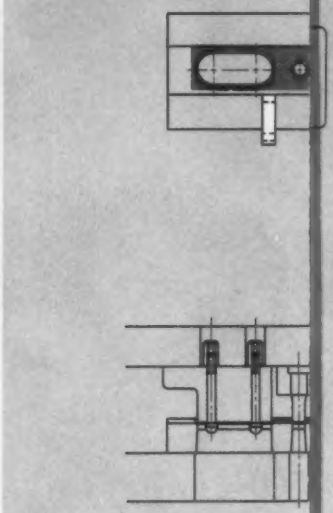
⅜ RM. THRU 2 HL'S P.F. AT ASS'Y
⅜ RM. THRU 4 HL'S-P.F. AT ASS'Y
¼-20 TAP THRU
⅜-16 TAP THRU C'BORE FOR ⅜ SOC. CAP SCR. 4 HL'S
¼ RM. THRU P.F.
SECTION A-A
SECTION B-B
PAQUIN RESEARCH COMPANY

14 **Final step in designing this die** is to fill in the bill of materials. Unless printed sheets are used, the border is applied, the paper is trimmed, and the die design is complete

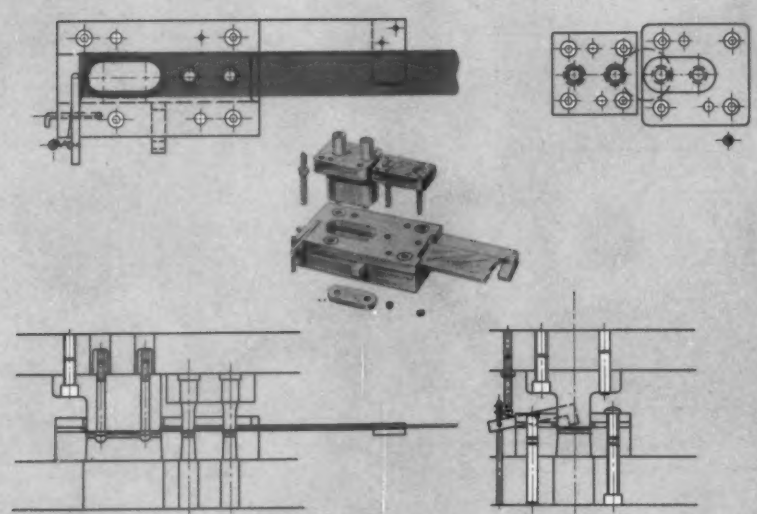
14 steps TO DESIGN A DIE



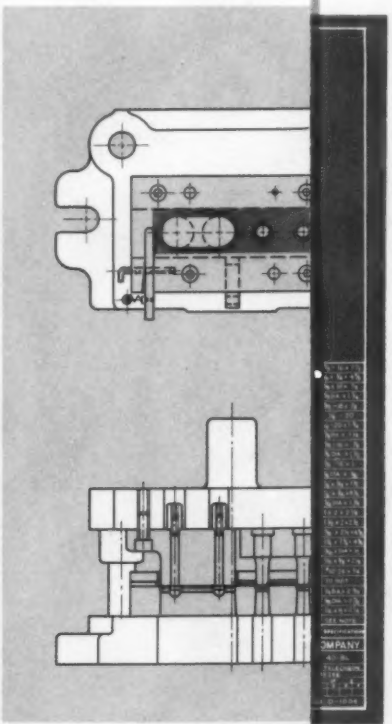
7 **Until now, the strip has not been located;** it simply lies on top of the die block. So, we now apply the back gage and front spacer, which guide the strip at its sides. Strip support A, if one is used, can be drawn in at this time



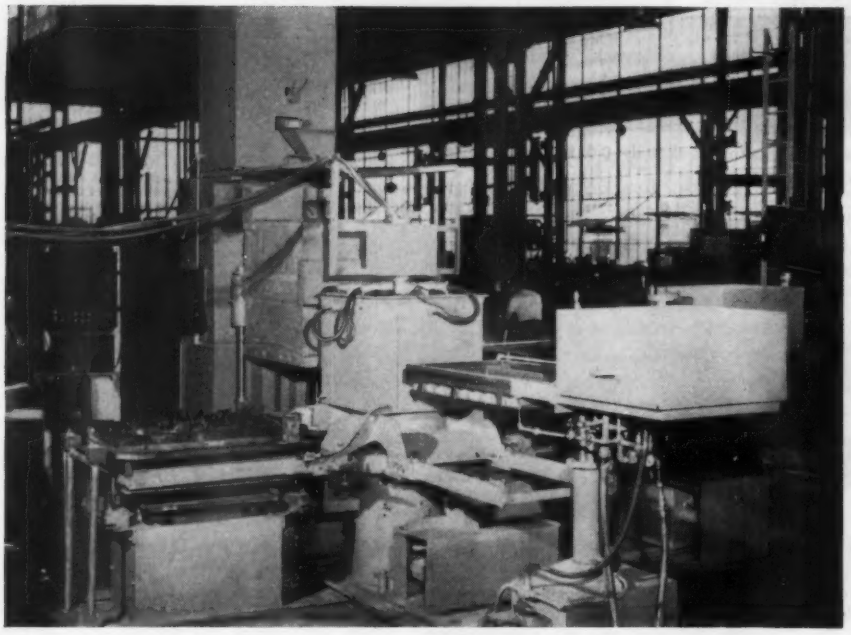
8 **Although the strip** endwise location. Sc the two holes in the upper right-hand vie hole will be entirely



11 **In this step, all screws and dowels are shown.** For press tools all dowels are the same diameter as the screws for any particularly member. Note that the relatively new button-head socket screws are used to fasten the solid stripper to the die block. Because of their low head weight, strength and clean lines, these are excellent fasteners for this application



12 **The die set,** which now completed. To result in considerabl sizes are increased



AUTOMATIC SHELL-MOLDING MACHINE does entire job of preparing mold. Pattern half is placed on table, rolled into oven, heated, and dusted with sand-resin mixture which fuses into "shell" adjacent to surface of hot pattern. Excess of sand-resin is shaken off, shell is stripped from pattern, and then mating shells are joined with cores to form complete mold. One operator makes four shells per min

How shell-molded castings affect shop practice

How can shell-molded castings simplify shop problems? We believe that the answer is much more important to you than the more readily available descriptions of the molding and foundry techniques. Here, categorized in terms of product form, is a detailed study of this relatively new process in terms of shop requirements. The author has an unusual background of shop and foundry experience

OTTO W WINTER, manager Shell-Mold Div, Beardsley & Piper Div, PETTIBONE-MULLIKEN CORP, CHICAGO

Machining problems, basically, resolve themselves into:

1. Surfaces of rotation—internal and external
2. Flat surfaces—internal and external
3. Regular contours—internal and external
4. Irregular contours — internal and external

Only a most unusual problem would require description beyond one or a combination of these groups. All of them have some relationship to shell-molding techniques. To simplify understanding shell-molded casting applications, here are some of the machining methods used to produce these surfaces:

Rotation, internal—drilling, reaming, spotfacing; boring, counterboring, grooving, chucking and centerless grinding; gundrilling and trepanning.

Rotation, external—turning, straight, taper, and necking; grinding, centerless and between centers; contour sawing.

Flat, internal — milling, shaping, broaching, slotting, filing.

Flat, external—milling, shaping, planing, turning, grinding, coining, sawing.

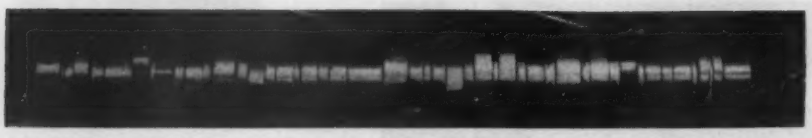
Regular contours, internal —threads – tapped, chased, ground; gears – shaped, broached, stamped, forged; splines, keyways, and serrations – broached, shaped, milled, upset.

Regular contours, external —threads – chased, milled, ground, rolled ; gears – cut, milled, hobbed, shaped, ground, stamped; splines, keyways, and serrations – milled, hobbed, ground, rolled, shaped; fins and grooves – turned, milled, broached, ground, rolled.

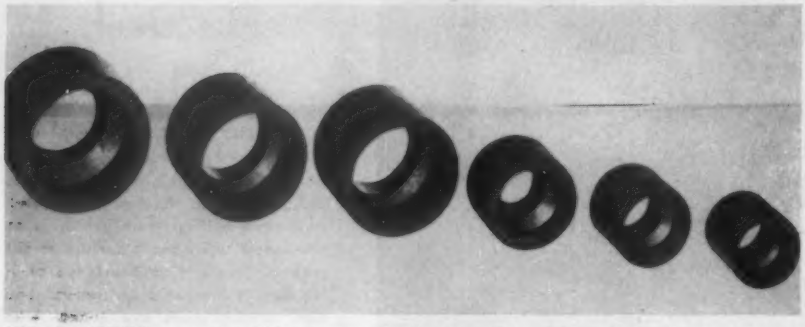
Irregular contours, internal—rotational contours – bore, planetary mill, internal form grind, forge, roll, spin; plane contours – hand finishing.

Irregular contours, external — rotational contours – turn, mill, grind, spin, roll; plane contours – mill, die-sink, hand finish, shape, roll-form, forge.

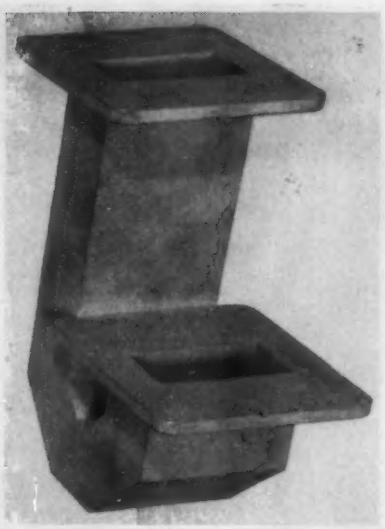
Making chips is not, necessarily, equivalent to making money. In fact, making chips can be a most expensive factor in manufacturing. The ultimate objective of the tool engineer should be to produce the part or product with a minimum of material waste in the form of



AUTOMOTIVE CAMSHAFT is shell cast ready for grinding, with only 0.035 in. stock allowance over final size. All linear dimensions are cast to size



MOTOR SLEEVES are cast within a general tolerance of ± 0.002 in. Shell-cast parts replaced screw-machine parts turned from bar. Cost was reduced 80%



WAVEGUIDE, cast from Alcan 125, was held to ± 0.002 in. on critical dimensions. Casting replaced fabricated unit, reduced cost of finished part 80%

chips and a minimum expenditure of time and equipment. Under ordinary circumstances, the straight line from raw material to finished product is the most profitable. However, many planners do not weigh all of the factors before they select, from habit, a routine of conventional methods.

The advantage of eliminating one or more machining operations is obvious. Considerably less apparent is the gain achieved by *reduction* of stock removal. For example, in turning cast iron, the power required for a ⅛-in. depth of cut is roughly ten times that required for a 1/32-in. depth of cut. This is the difference between a 5-hp machine tool and a 50-hp machine tool. How often have *you* used this factor in broadening the application of your shop facilities? Full utilization of this difference can materially reduce capital investments and tooling costs; can give competitive advantage to a bid.

Of course, the ultimate, if somewhat altruistic, condition is to cast the part to size, ready for use. Shell molding approaches this ideal to the point where only finish-machining operations are required.

With the development of nodular irons and pearlitic malleable irons, which possess high tensile strength plus ductility, forgings can be replaced by castings in many places. Furthermore, shell-molded castings can be produced in practically any metal. While low-carbon steel, high-purity copper, magnesium, and titanium require special techniques, even they are shell cast.

WIDE SIZE RANGE

In general, this article is based on castings weighing 50 lb or less, although shell molding is not limited to parts under 50 lb. Parts weighing over 200 lb have been successfully cast. However, pattern cost plus mold handling and preparation require special consideration. Similarly, shell castings are being produced with zero draft, but to provide back draft requires the use of cores and tricky molding, hence lost-wax investment casting is preferable for some small parts.

There is a somewhat widespread idea that shell-molded castings are expensive. This opinion stems, primarily, from earlier techniques using large quantities of costly phenol-formaldehyde resin as a binder for the mold sand. Current developments are cutting resin costs in half. In any case, before a process is called "expensive," it is wise to weigh all of the elements contributing to the cost and to weigh the savings accruing from the advantages of the process. Even when shell-molded castings cost more than conventional castings, the total cost of the end product should be the sole criterion. The great savings resulting from this technique are made in the machine shop.

Shell-mold patterns need not be costly. Low-cost methods and constructions, plus a wide range of pattern materials, are now available. Consequently, selection of pattern construction and material is largely a matter of economics, based upon the volume of production and the required precision.

With the proper automatic equipment, shell-mold production costs can be very low. The process lends itself to "automation" methods. One unskilled operator, even female, can produce four molds per minute. A similar operator can produce enough shell cores to keep pace. Between the two, molds can be assembled and cores set, ready for pouring. If cores are not required, the mold-machine operator can work alone. Another unskilled operator can mix (resin coat) sand to keep pace with the molder. Dumping and shakeout operations can be automatic. Gate cutting and cleaning operations are slight; are usually handled by one person. Two men are needed for pouring. The cost of sand and resin must be weighed against die

and mold deterioration in comparing over-all costs.

The life of shell-mold patterns is considerable, provided that they are properly handled. Limited indications and records are that alloy-iron patterns wear about 0.0001 in. per 100,000 shells, that bronze patterns wear 0.0003 to 0.0004 in. for the same number of shells, and that aluminum patterns wear from 0.003 to 0.004 in. under the same conditions. Wear varies with the amount of draft on the pattern. As draft is decreased, wear increases, as might be expected. Poor quality in a pattern can add to the cost of every casting produced from its molds.

ADVANTAGES IN THE SHOP

Machining operations normally done for clearance purposes are usually eliminated. It is seldom that any such clearances need be specified so closely that shell casting to size will fail to produce the desired result.

Surface finish on castings produced from shells is commonly 100 to 120 mu-in. rms. Some castings are produced as smooth as 60 mu-in. rms. This quality will greatly reduce, or eliminate, secondary polishing operations. Cleaning operations usually are reduced to an air blast or a wire-brush operation in spots where there is a slight adherence of sand to the casting. Occasionally, a fine sandblast is used to prepare the surface for painting or to provide a uniform surface color.

Thin sections hitherto unattainable can be successfully shell cast. This ability is especially good for ferrous metals. For aluminum alloys, many thin-section shell castings are reported to have better physical properties than when die cast. When machining thin-sectioned parts it is imperative to minimize stock removal; thus minimize machine loads and the excessive clamping pressure which tends to spring the casting out of shape. Examples include motor frames and end bells.

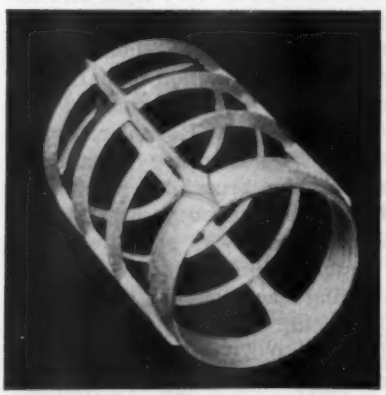
Opportunities for tooling simplification extend beyond the obvious economies resulting from the elimination of machining operations. With greatly reduced stock removal, hence lower cutting pressures, jigs and fixtures can be made lighter and less expensively. This rule applies to all details such as frames, clamps, supports, and stops. Fixtures and other workholders can be made faster operating by greater use of toggle and cam clamps (even solenoid-actuated) that provide adequate pressure.

Because of the consistent size and contour obtained with shell-molded castings, it is possible to use inexpensive fixed stops and supports, rather than adjustable or fixed-adjustable supports. And the latter also require more time and skill for operation and adjustment. Trends toward automatic operation require that parts entering a machine cycle have a high degree of consistency. Shell molding provides this quality with a minimum of pregaging.

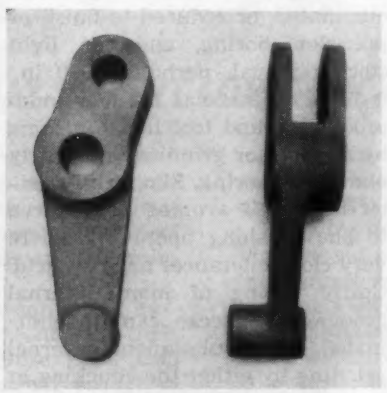
Greater than normal use can be made of cheap plastic jig and fixture bodies and frames. The casting itself can be used as a master for forming these workholders, as well as for locating supports, stops, and clamps. Use of soft jaws, contour jaws, low-melting-point cast jaws, and pot chucks for chucking a "rough" casting is entirely practical. Automatic chucking of rough castings is common practice.

Angular location points such as gear teeth, splines, and keyways can be shell cast with a consistency and accuracy which permits cleanup of finish machined surfaces with as little as 0.010 to 0.015 in. of stock removal.

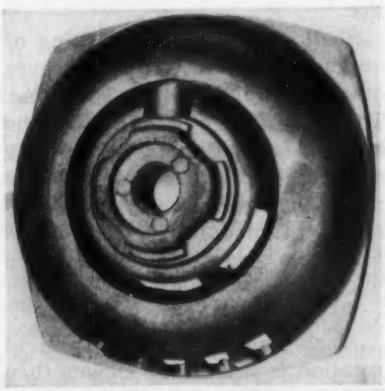
Cutting-tool life is considerably better on shell-mold castings than on conventional sand castings. In the first place, shell castings do not plague the user with sand inclusions, hard spots, porosity, blowholes, etc. Then, as mentioned, the shell casting requires less cutting force because cuts are shallower, hence tool loads, friction, heat, and



OUTDOOR-LIGHT GUARD is shell cast complete with thread and ready for use as-cast. If parts are to be painted, a light sandblast is beneficial



RATCHET DRIVE BRACKET, shell cast in iron, saved 70% in machining operations. Slot dimensions are held within 0.004 in. Holes require reaming of 0.006-in., centers within 0.005-in. tolerance. Surface finish is equivalent to fine sandblast



MOTOR ENDBELL is shell cast in alloy gray iron within general tolerances of ± 0.002 in. All rough machining operations were eliminated. Weight was reduced 30%. Final part cost was cut 60%. Shaft hole is cast with 0.005 in. stock for reaming. Frame-joint ring is cast with 0.015 in. stock for precision boring, eliminating previous rough and finish boring operations

wear are reduced. Field reports tell of machining shell castings with stock removals of 0.030 in. in which broach life was increased 6 to 7 times over previous results with ⅛- to 3/16-in. depth of cut. Adding resharpening, replacement, setup, and downtime, this is a substantial saving.

MINIMIZING MACHINING OPERATIONS

Turning external surfaces of rotation can, in general, be reduced to finishing operations such as centerless or between - centers grinding. Shell cast cylindrical sections usually can be cast sufficiently round to true up in two or three passes, either infeed or thrufeed, on a centerless grinder. Centering is commonly done within 0.010 in. and normal amounts of grinding stock suffice. For example, automotive crankshafts are being cast within 0.040 in. total stock on the diameter and all turning operations are eliminated. These c'shafts usually measure about 3 ft long.

The grinding - stock allowance varies with the job. A short, small-diameter shaft requires 0.015 in. A long, slim shaft, on the other hand, may warp on cooling, hence require as much as 0.040 to 0.050 in. on the diameter.

This allowance can be minimized by proper mold making and handling. All of the results herein described are based on good practice.

Shell casting permits casting of necks at shoulders plus grooves otherwise difficult to machine. Thus, it often will eliminate the turning operation, leaving only grinding for completion of the part. The excellent physical properties of nodular and pearlitic malleable irons make them a worthwhile consideration for a variety of shafts.

Machining internal surfaces of rotation is invariably slower than for external surfaces and involves the use of costlier cutting tools plus higher tool maintenance cost. As a result, shell molding offers even greater advantages here. Most drilling operations can be eliminated by using shell molds and cores. Then only reaming or grinding are required. Exceptions to this are very small holes and holes at odd and difficult angles

CASTING SMALL HOLES

Holes as small as 1/16-in. dia are shell cast in small pieces and in thin-wall work. The smallness of the hole size that is castable depends upon the metal mass of the casting, the amount of movement around the point in question during pouring, and the temperature at which the metal is poured. Thus, a heavy casting with a high heat mass would burn the binder out of a small core or mold section and allow it to crumble before the casting solidified.

Because a shell casting does not have a hard skin, reaming the as-cast hole is simple. Stock allowances for reaming are the same as for drilling and reaming, hence hole size as cast would be the same as a drilled hole size prior to reaming. Hole-location tolerances, however, may necessitate additional stock allowance for cleanup as a result of casting distortion and warpage during the cooling phase. Again, this problem requires certain precautions in shell casting.

Spotfacing seldom is necessary, except where the parting of the shell casting results in backdraft. However, this often can be eliminated by a relief or a fill-in for drawing, or by using the as-cast face of the part.

Boring operations usually can be eliminated, or reduced to finish or precision boring, and the light stock removal, perhaps 0.010 in., is highly beneficial for maximum production and tool life. Finishing by reaming or grinding frequently eliminates boring. Similarly, counter-boring is avoided or reduced to one finishing operation where very close tolerances must be held. Costly boring of many internal grooves and necks can be eliminated. For subsequent internal grinding by either the chucking or centerless method, shell castings provide an external surface of uniform size and roundness that permits chucking without machining the OD and centerless internal grinding with only a slight cleanup on the OD. This is particularly true where the work is held in a jaw chuck; often is true for pot chucks. The amount of stock left for internal grinding need be no greater than that left by boring or other pre-grinding operations.

Internal broaching is greatly simplified. Shell coring the size and contour close to final dimension, thus reducing the amount of stock to be removed, permits long and expensive pull broaches to be replaced by short push broaches. This change also permits less-expensive broaching machines. Again, the absence or reduction of chill and hard skin in a shell casting makes this possible. Otherwise, the broach would be ruined on the first pass.

Elimination of machining on flat surfaces is primarily hampered by casting distortion and warpage during cooling. While this can be expected in any casting, proper shell-casting procedure produces very flat surfaces, comparatively speaking. Because shell castings can be made with zero draft, a certain amount of precision is possible. Zero-draft surfaces as high as 4 in. have been produced, and 2-in.-high surfaces are common. Generally, in any case, just a few thousandths of an inch of draft will suffice.

FAST METAL REMOVAL

The amount of stock to be machined can be very slight, thus very high speeds and feeds can be used as well as very light and inexpensive milling fixtures and machines. This condition, plus the absence or reduction of hard skin on as-cast surfaces, permits surface broaching. However, broach length and cost are greatly reduced; the broaching machine is less expensive because of shorter stroke and lower pressure.

Facing, in turning, boring, and drilling operations can be extremely rapid, with removal of only 0.010 to 0.020 in. of stock. Frequently, flat surfaces can be finished by simply disk grinding or belt sanding, especially where a cleanup is sufficient for final flatness. Where a close dimension must be held, it is entirely practical to precision grind the rough casting.

Planing and shaping are only

slightly affected by shell-casting benefits, primarily because they are not as "high-production" operations as turning, milling, and broaching. Planing, particularly, is a large-casting operation. However, because of the small stock allowance, light fixturing or clamping can be used to make quantity setups of small parts on the table of a good planer. A milling attachment can be used to achieve high output.

Coining operations, such as are sometimes required on malleable iron castings, steel castings, or forgings, frequently are eliminated.

Milling of internal flat surfaces is a difficult operation; usually requires expensive, special internal-milling attachments that are too flexible to take heavy cuts. When such surfaces are shell cast to size, a costly operation and costly tooling are avoided. Even allowing for slight stock removal provides a sizable saving.

Broaching of internal flat surfaces provides the same benefits as the previously described broaching operations, plus a somewhat greater saving in the more expensive internal broaches.

Slotting is a slow and expensive operation, yet it often, as for blind holes, is the only available means. Sometimes a push broach can be used, but this tool requires chip clearance at the bottom of the hole and, usually, several broaches have to be used in stages to remove all of the stock. If the shell casting is not cast to size, thus eliminating the problem, final stock removal is readily accomplished with a one- or two-cut push broach. A relief groove at the bottom of the hole produced by a shell core easily provides the necessary chip space. When slotting is required, the reduced stock removal eases the job.

External regular contours, such as threads, are produced by shell molding to class-one tolerance. The foremost problem exists at the parting line and, commonly, flat spots are provided either on the pattern or ground on the casting to eliminate parting-line burr. Though not yet in general use, means have been developed to hold parting-line tolerances within plus or minus 0.002 in. The tensile strengths of some of the modern casting alloys make this worth looking into.

Threads can be rough shell cast, then finished by chasing, finish-milling, grinding, or running a die over the as-cast thread. Angular location for thread pickup is relatively dependable. Shell-cast gears are adequate for slow-speed operation; are consistently located from the teeth in subsequent hole-finishing operations such as reaming, broaching, or grinding. Gears include spur and bevel varieties. Integral studs or trunnion shafts on gears can be finish ground by location or centering from the teeth. More precise gears can be cast to size and finished by cutting, hobbing, shaping, or grinding. Splines, keyways, and serrations can be shell cast, sometimes to size. Cast horizontally, splines and serrations require shell cores; cast vertically, the pattern requires draft. Keyways can be made in the mold without cores. Fins and grooves can be produced to size or ready for operations such as finish grinding.

Internal threads are cast to size and within class-one tolerance on some jobs. Pipe threads that withstand 60-psi hydraulic pressure are in production. Using a precise metal core box, the mark at the parting line is more optical than actual. Tapping as-cast holes is common practice. For very close tolerances, a pre-reaming operation is recommended. Internal gears, splines, keyways, and serrations can be cast to size for some applications; are readily finished by shaping or broaching for more accurate specifications.

Accurate internal and external irregular contours are readily produced in quantity by simply making one accurate pattern. Used as-cast or with minimum stock removal to cleanup, many otherwise difficult or impossible tasks are accomplished at very small expense.

AUTOMATIC MACHINES MAY DISRUPT COMMUNICATIONS

• The Navy's Bureau of Ships, as well as Army and Air Force agencies, are concerned with one unwelcome result of the industrial trend toward automation—radio interference caused by complex electrical gear used in many new machine tools and other industrial equipment.

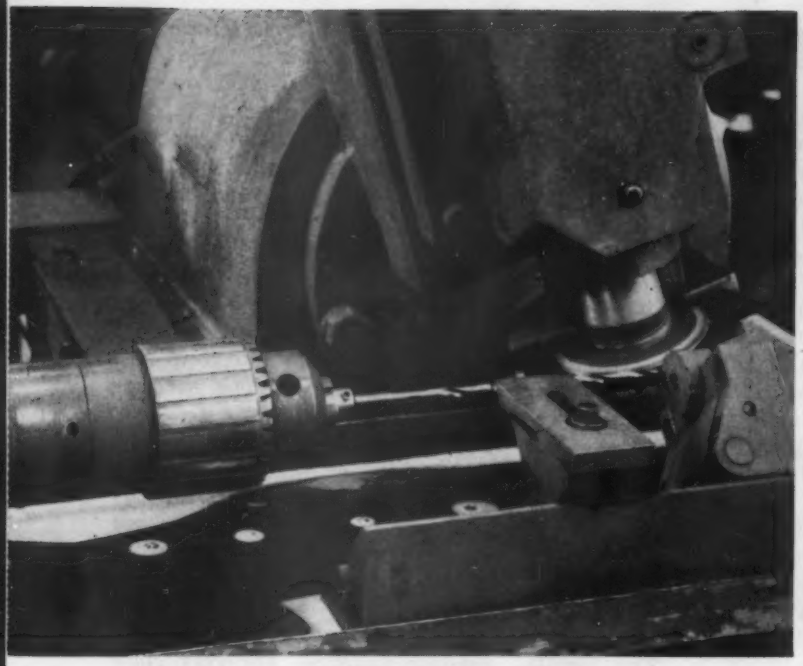
Such machine accessories as fluorescent lamps, buzzers, position-indicating devices, controls, limit switches, and commutator motors cause radio-band interference, and in some cases it is strong enough to disable communications. Two examples: An airline noted that radio contact was impossible along a section of its Tennessee route. FCC mobile monitors traced the interference to an industrial heater in a Memphis plywood plant, 500 miles away. A Coast Guard station at Alexandria, Va, reported strong interference traced to an industrial heater in Yonkers, N Y.

Radio interference caused by industrial machines has been known to interfere with radar, and to confuse radio-control devices on guided missiles. It can also ruin TV reception.

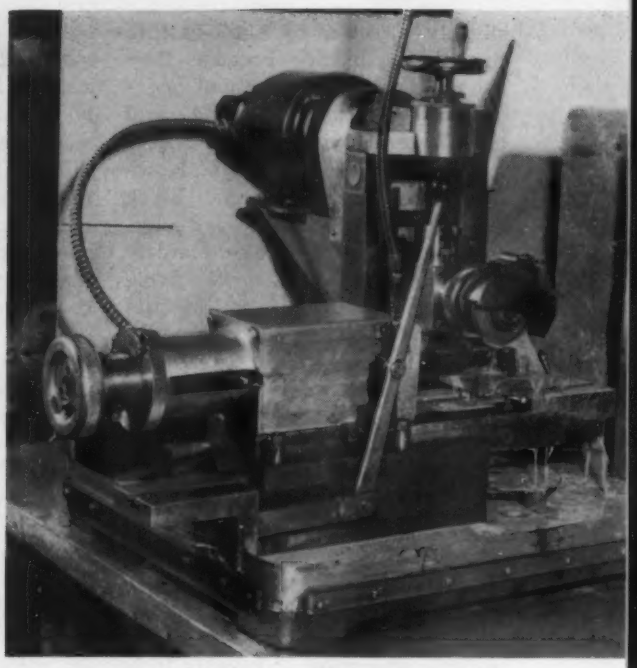
Often the interference is caused by electrical devices that are not working properly; but in other cases the interference sources are electrical elements that must work this way; and must therefore be fully shielded.

The problem is acute in spots, and is likely to become more widespread as machines become more complex. One way to lick it, aside from shielding, is to redesign machines that cause trouble from the frame outward, providing electrical elements that are known not to cause interference. This solution is preferred by the Navy to any other, and for that reason the Bureau of Ships is anxious to consult with machine designers to help them solve the problems of substitution.

(*American Machinist* for Nov 7 will carry an article covering the problem in more detail.)



SOLID-CARBIDE twist drills are ground from the solid in a single pass on a special machine built by Atrax. Blanks are held in a simple adapter in a Jacobs chuck, and the wheel is tilted to the helix angle. Machine cycle is fully automatic, including flute-to-flute indexing



ODD-LOT SIZES are fluted on Atrax machine requiring manual feeding of work, and only about 0.003 in. of stock is removed per pass. Rotation of drill is controlled by helical cam partly visible through slot in housing (left). Index handwheel controls change from flute to flute

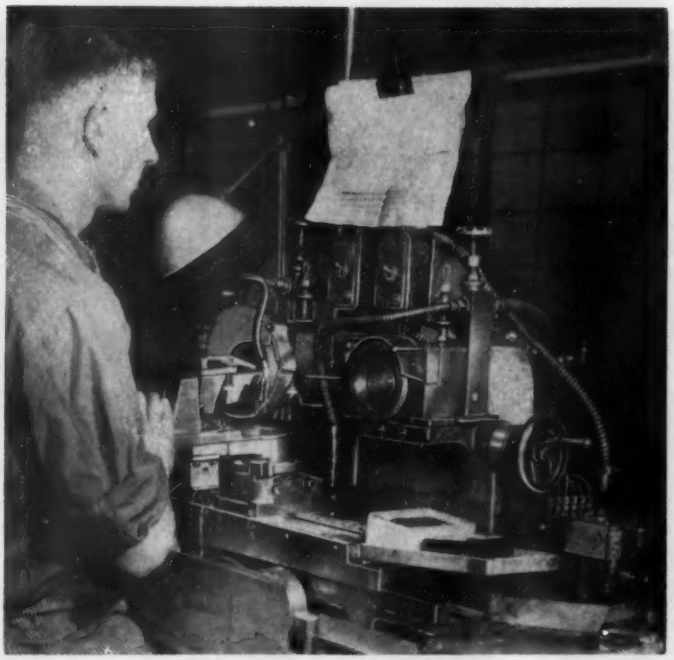
Diamonds, wax, and skill shape

FRED A WOLD, general factory manager, THE ATRAX CO, NEWINGTON, CONN

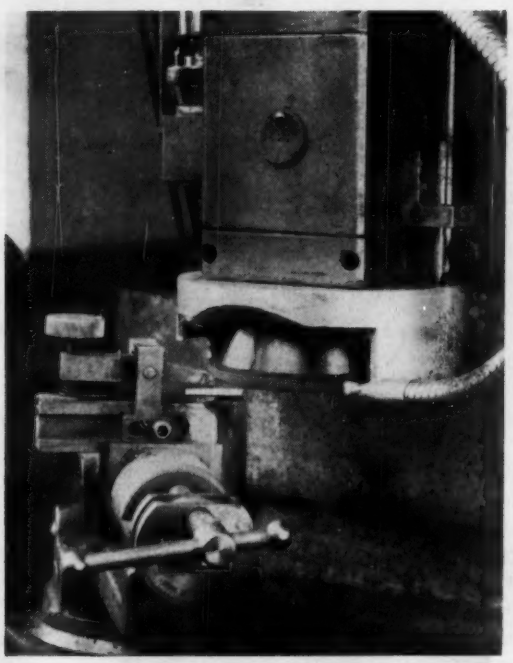
One of the largest users of diamond wheels in the country, with an annual consumption of almost a quarter million dollars, Atrax Co has developed the diamond grinding of carbide to exceptional efficiency. A normal inventory of wheels is kept on hand, and manufacturers maintain regularly scheduled delivery service on a standing-order basis to keep this approximately constant. Face, cup, peripheral, and saucer types are employed in a variety of diameters, grits, and concentrations.

Atrax does not manufacture its own carbide, but purchases blanks or random-length rod from various producers. Hence, the chief thing the company has to sell is the quality and price of its product. And both of these depend to a great extent on the cutting fluid employed. With only a few exceptions, all grinding is done wet, and the company has carried on an extensive testing program to discover the most suitable material for its purpose. Requirements are a low surface tension to permit the sludge to sink quickly in the settling tank and avoid its being carried back to the wheel and scratching the work, and freedom from odor and rancidity. It must not load or gum the wheel, and must have high heat-absorbing properties. It must not support bacterial growth to infect cuts or cause dermatitis.

All these conditions have been met successfully by Johnson's Wax Coolant No TL 131, which is now standard for all but one of the grinding operations. Standard mix is 2 quarts to each 40-gal tank of water (80:1). Tanks are filled on a Saturday; the following Saturday, 1 pint of wax concentrate is added to top-up the mixture. The next Saturday, the tank is emptied and refilled with a new mix. This is in contrast to the weekly change necessary with most other compounds. More important, wheels do not gum up over the weekend, so production grinding can start first thing on Monday morning. With most other compounds, wheels were caked on Monday morning and required excessive dressing to get them back into shape. Usually, they were not back to full free-cutting condition before Tuesday morning. This involved a serious loss of production and excessive wheel consumption. An idea of the savings effected by the wax coolant may be had when it is realized that grinding four helical flutes in a ½-in-dia end mill takes 11½ min; with soluble oil, it took 25 minutes.



SQUARE BORING BITS are ground on Atrax-built machine equipped with two diamond wheels, 320-grit for roughing, 500-to 800-grit for finishing. Swivel fixture permits grinding both angles and nose radius in a single setup. Finishing wheel (right) is set 0.0005 in. ahead of rougher so fixture need not be moved in or out



BACK-AND SIDE-RAKE angles are ground on boring bits with a cup wheel, using simple holding fixture in special universal vise. Machine was a standard grinder but was fitted with a new spindle built by Atrax to its own specifications for accuracy

carbide tools

There are no secrets to making solid carbide tools, but there are lots of tricks to learn if you are going to do it on a competitive basis—and you need some special machines that you can't buy

SALVAGE PROBLEM

Because of the tremendous volume of wheel consumption, salvage becomes an important factor, and the company estimates that the measures it employs effect about 27% recovery. All dry grinders are coupled to Dustkop filter units, one to each two machines, and dust is collected weekly into steel drums. The filter pads through which the air is exhausted are also changed weekly and stored in separate drums. For cleaning machines, either wet or dry, only cotton waste is employed, and this is collected in drums placed outside the building because of its possible fire hazard. Wiping cloths are used only for cleaning hands and are laundered in the regular way, as it is not considered that sufficient diamond dust could be recovered from them to pay for the cost of recovery.

Coolant tanks for the wet grinders are drained every two weeks, and the sludge collected. Tanks are then hosed down to make sure they are properly clean, and the rinse water is drained off through a special line into a large settling tank buried underground. This tank is emptied at intervals of perhaps 2 to 3 years, depending on necessity.

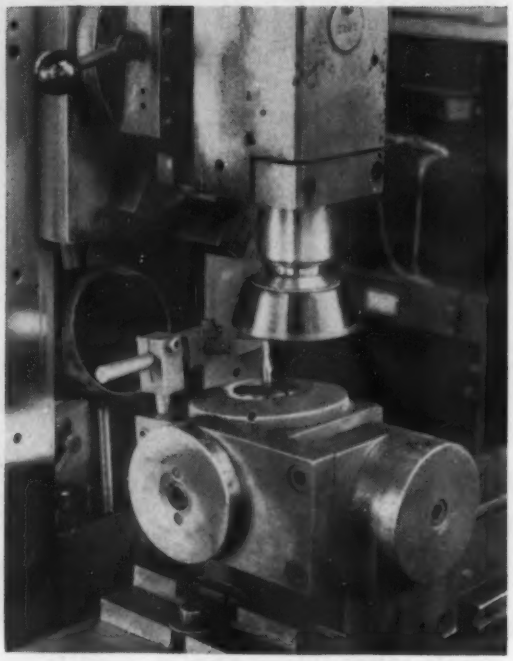
Salvaged material, both wet and dry, may be disposed of to recovery specialists, payment being made on the basis of the weight of diamond recovered. Or it may be returned to the wheel maker for recovery.

PRODUCTION METHODS

Because of extremely high quality requirements, nearly all the machine tools used for production are built by Atrax in its own toolroom. Where standard equipment is employed, the company removes the spindles and either rebuilds them to its own standards or replaces them with those of its own construction. This would appear to be an expensive system, but experience has shown that it pays off liberally in terms of spindle life. Many spindles have been in continuous use for over five years and still show no measurable play.

Twist drills, reamers, and end mills are big-production items and may be made from a standard blank, pointed at both ends, or cut to length from carbide barstock. The latter operation is performed on a Felker cutoff machine using a 7-in. wheel, 1/16 in. wide, of 100 grit, 100 concentration. Two ma-

FLUTE RELIEVING on end mills or other tools is handled on this special machine. This is one of the few grinding operations performed dry to permit the operator to keep the work under close observation



END TEETH of end mills are ground in this special, universally adjustable fixture. Machine is the same as used for flute relieving and was designed by Atrax, built in its own toolroom

chines operate 18 hr a day, cutting wet with Johnson's wax coolant. Despite the heavy service, each machine uses only two wheels a month—a substantial reduction over what was required with other coolants.

Blanks are ground on a semi-automatic cylindrical grinder equipped with automatic hydraulic infeed, using a 10-in. wheel with 3/8-in. face, 150 grit, at 2200 rpm and a work speed of 300 rpm. Johnson's wax coolant TL 131 is used as grinding fluid at 80:1 concentration. Work is then transferred to an Atrax flute grinder. The shank end is inserted in a simple sleeve and locked with a setscrew, and the sleeve gripped in a standard Jacobs chuck. The sleeve reduces the risk of breakage and saves wear on the chuck jaws. The point end bears against an end stop on the tailstock, and a flat plate bears against the side to act as a steadyrest. A 220-grit diamond wheel is set to the helix angle of the drill, and the full flute depth is ground in a single pass, using the wax coolant. At the end of the pass, the machine reverses and the drill indexes automatically for grinding the second flute. Flutes so cut have an extremely high polish and require no secondary operation. Time varies with the particular job, but a ¼-in. drill with 5-in. flute length can be ground on both flutes in a total of 13 min, and one man handles three machines. The machine normally handles drills up to ½ in. in dia, reamers and end mills up to ¾ in. In the latter case, the depth of cut is 0.145 in., a tremendous amount of stock to be removed in one pass.

Wheel wear is approximately 0.001 in. per drill for a ¼-in. drill. Lead is adjustable from ¼ in. to 16 in., and the number of flutes can be varied from 1 to 24. Front taper for reamers can be varied up to 10° a side.

Odd-lot sizes are fluted on hand-operated machines, as production requirements for these are considerably lower. On these machines, the wheel spindle is horizontal and the workholding spindle is advanced and retracted by hand-operated lever. At the end of each stroke, the wheel is fed down 0.003 in. by means of a handwheel. Rotation of the work is controlled by a cam having a helix corresponding to that required on the work. When one flute is finished, the work is indexed to the next flute by a handwheel and index plate. Time on this machine is 7 min. for one flute, 1 ¾-in. flute length on a ¼-in. drill.

Flute relieving is performed on another Atrax machine with a cup wheel. A sub-table carries a pair of centers or other conventional workholder, and can be tilted to permit taper grinding. For grinding the end teeth of end mills, the sub-table can be removed and a special collet-type fixture installed. This latter can be pivoted in two planes. Both these operations are performed dry, as it is necessary that the operator keep a close watch on the work. Drill pointing is performed on a standard Sellers drill point grinder, one of the few standard, unaltered machines in the plant.

Combination center drills and countersinks, form counterbores and end mills, and similar tools must be form relieved axially and/or radially. For this, a No. 2 Cincinnati cutter grinder has been equipped

with special fixturing and a special electronic variable drive unit for the work head. Two quick-change cams, one for radial relief, one for axial relief, permit applying the required amount of relief to any desired number of flutes.

CARBIDE BURS

An almost endless variety of shapes and sizes of carbide burs is produced by Atrax. Sizes up to and including ¼-in. cutting diameter are of solid carbide—larger sizes have solid-carbide heads brazed to heat-treated steel shanks. For this operation, the base of the head and the top of the shank are fluxed and "tinned" with silver solder in small batches, about 20 at a time. The shank is then placed in a small V-block fixture and held with a thumbscrew. The head is placed on top without any particular care for centering. Heat is applied with an acetylene torch until the brazing metal melts. Then a special head is lowered quickly over the work. This has three spring-loaded fingers that center the bur accurately on the shank, while the weight of the head applies pressure to hold it firmly in place until the braze solidifies.

Grinding the teeth of the burs is a specialized operation performed on a machine designed and built by Atrax. Its working cannot be described, except to say that it employs suitable cams to provide the various complex motions needed to cut the flutes on any desired contour and to any depth and spacing. This is the one operation where a standard grinding oil is used instead of wax. The reason for this is that the wax coolant is so free-cutting that it will leave a feather edge on the flutes. This is not desirable on a bur, as it may lead to chipping of the edge. The slower-cutting oil does not produce this effect.

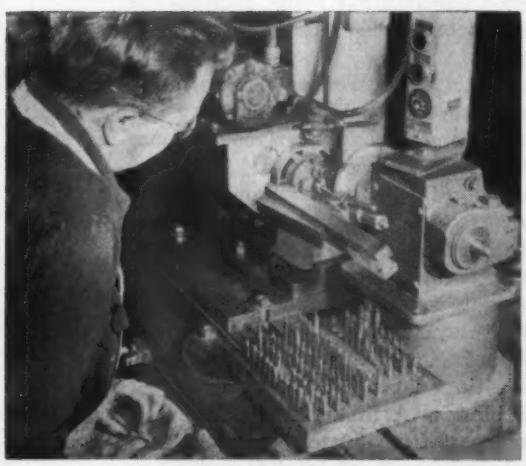
INSPECTION

A most unusual feature of the Atrax plant is "on-the-job inspection." There are many good reasons for this method. First of all, the materials worked with—carbide and diamond—are extremely expensive. Maximum care must therefore be excercised to avoid spoilage at all phases of operation. For example, if a ½-in.-dia end mill is inspected at OD grinding and found to be faulty, only the blank and one or two operations can be considered lost. Whereas, the same end mill found to be faulty at final inspection would have to be considered as a total loss. Supervisors and work leaders constantly check each operation to eliminate errors, thereby curbing unnecessary lost time and expense.

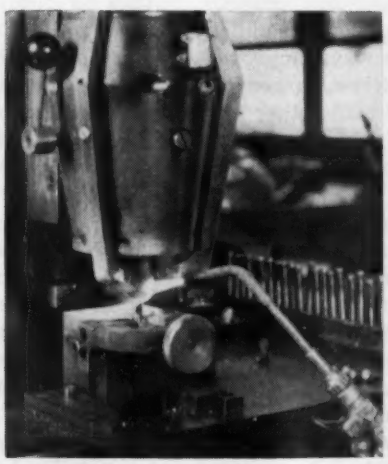
There is, however, still a final inspection dep't for all tools the company produces, to insure faultless service to the customer. All incoming material is also inspected. Equipment in the inspection dep't includes several optical comparators, electro-limit gages capable of measuring in millionths of an inch, high-power microscopes, rake-testing equipment, relief-checking devices, and other precision equipment necessary for the production of quality-controlled carbide tools.

STOCKROOM AND SHIPPING

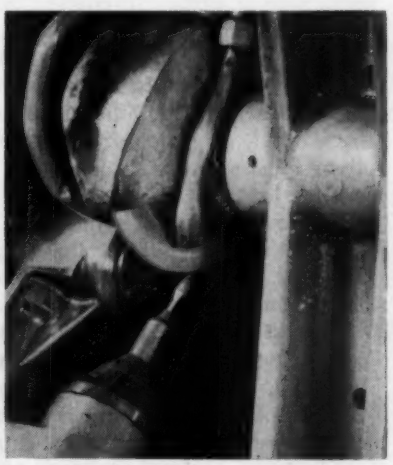
A huge stock of finished tools is carried at all times to insure immediate service. Indeed, over 90% of all catalog items can be shipped from stock. Tools are individually racked to avoid chipping or other shelf damage and are packaged in individual containers for safe transit. The company, incidentally, needs no shipping trucks—daily shipments of thousands of dollars worth of precision carbide tools ride comfortably on the front seat of a car for delivery to the Post Office.



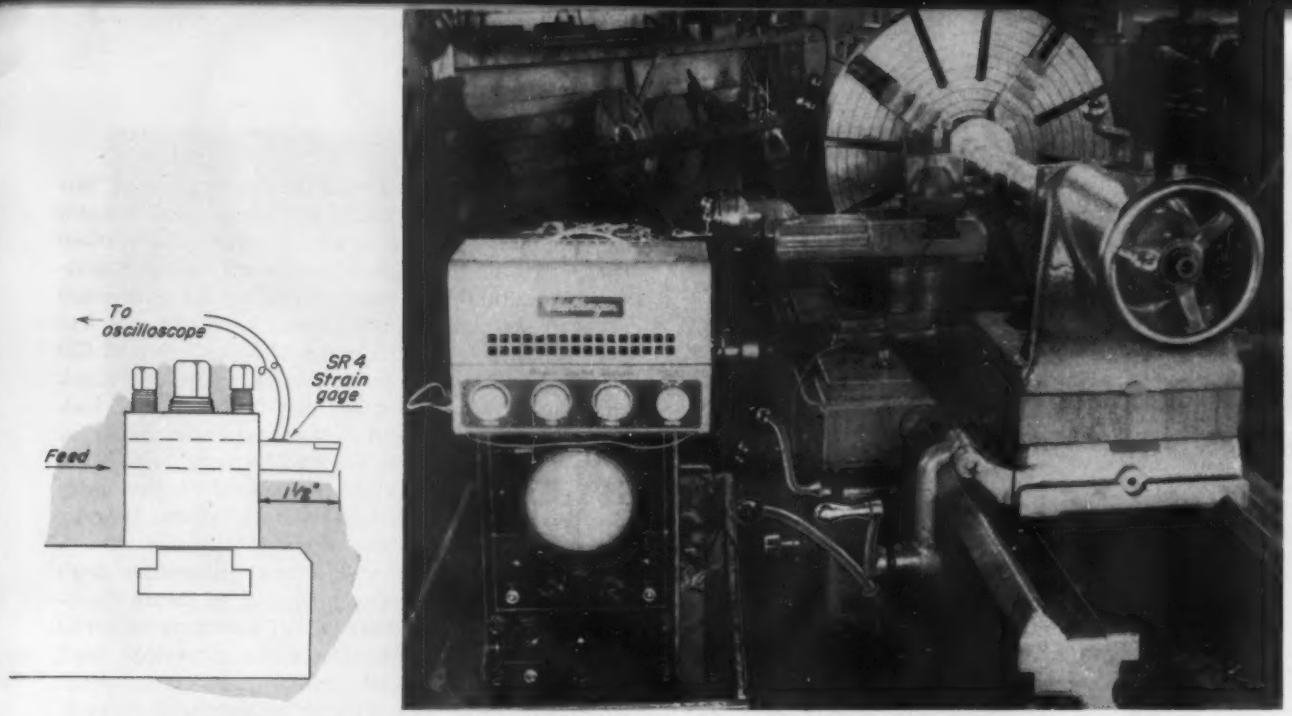
FORM RELIEVING of specially shaped end mills is handled on this special machine which will produce a combination of axial and radial full eccentric relief to extremely close limits of accuracy



LARGE-DIA BURS are silver brazed to shanks in this ingenious fixture. Bur is placed on shank and heat applied by hand-held torch. When braze metal flows, centering head is lowered and three fingers automatically center the head with the shank



MACHINE GRINDING the teeth of solid carbide burs is performed on a special machine which can be made to follow any desired contour by means of suitable cams



TEST SETUP on large engine lathe in Kennametal plant used a cathode-ray oscilloscope and SR4 strain gages to measure the amplitude of vibration developed when carbide-tipped tool was power fed at 0.0038 ipr radially into 3 1/16-in.-OD, 0.15% C steel test log turning at 192 rpm. Oscilloscope patterns were photographed each time. Tool was clamped solidly in open-side toolpost with 1½-in. overhang. All cuts were taken under identical conditions

High-modulus tool shanks cut

Oscilloscope studies prove that the stiffer the shank the less the chatter. Solid carbide shanks give maximum rigidity

W L KENNICOTT, chief engineer, KENNAMETAL, INC

Chatter developed during metal-cutting operations almost always can be traced to lack of adequate support for cutting surfaces of the tools. In recent years, machine-tool designers have done much to eliminate or minimize chatter by providing heavier machine beds, heavier and better supported saddles, rams, slides, and tool blocks; wider ways, improved feed screws and nuts, more direct drives, larger and more accurate spindle bearings, and many other features. Yet, single-point tools used for many operations must project as overhung beams to take the cutting loads.

Obviously, the stiffer the beam formed by the tool shank, the better will be the support for the cutting surfaces. Beam stiffness is, of course, a function of the modulus of elasticity of the beam material. Suitability of a given material for use in tool shanks also depends to some extent upon its density (specific gravity), because heavier materials provide more inertia to resist vibration which causes chatter.

In most cases, shanks of single-point tools are made from steel, which has a modulus of elasticity of approx 29,300,000 psi, and a density of approx 7.8 gm per cu cm—no matter what alloy additions, heat-treatments, or method of production (casting, forging, cold finishing, etc) may be used.

Shanks of copper-nickel-tungsten alloys have been advocated to reduce chatter or vibration—on the basis of their higher modulus of elasticity (about 40,000,000 psi) and greater density (approx 16.9 gm per cu cm). Both these improvements in properties help provide stiffer tool shanks—thus reducing chatter appreciably.

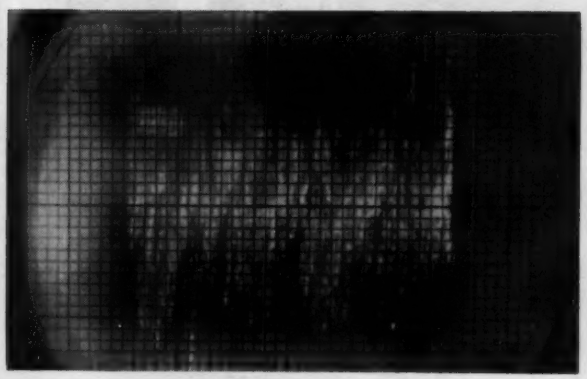
Use of cemented tungsten carbides as a tool-shank material also is worthy of consideration. They have been used with outstanding success in making chatter-resistant boring bars for precision finishing bearing bores of considerable length, as compared with their diameters. Also, solid-carbide grooving tools have helped cut the cost of finishing aluminum-alloy and cast-iron pistons for reciprocating engines.

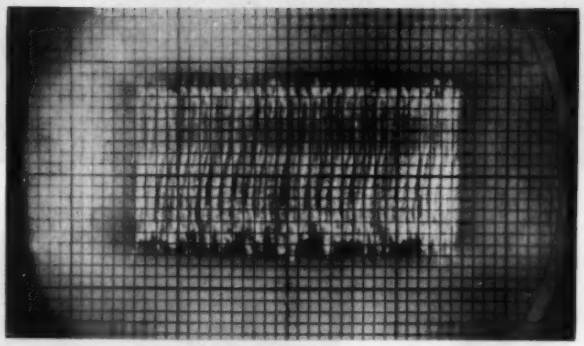
In one case, an automobile maker jumped production of aluminum-alloy automobile pistons from 800 to 18,000 pieces between grinds by replacing conventional carbide-tipped grooving tools with solid Kennametal K6 blades. A maker of truck engines cut grooving tool cost from 30 to 4¢ per thousand cast-iron pistons, and increased total tool life from 22,500 to 390,000 pistons, when solid tungsten-carbide grooving blades replaced carbide-tipped blades.

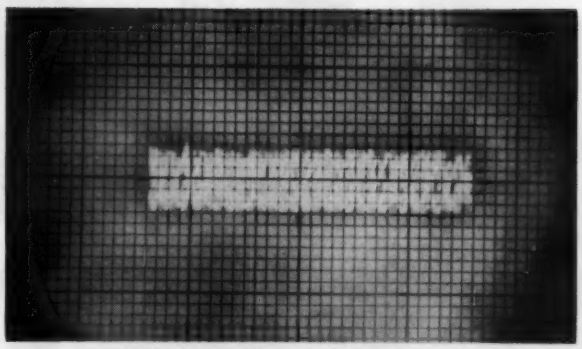
Cemented tungsten carbide has a modulus of elasticity of approx 94,300,000 psi (more than three

SEVERAL PLUNGE CUTS were taken with each tool. In above view of the 0.15%-C steel test log, the four cuts shown were taken (left to right) with tools having (1) solid K6 tungsten carbide, (2) copper-nickel-tungsten alloy, (3) SAE 1095 steel, and (4) brass shanks. Differences in chatter developed are readily apparent

lathe chatter







OSCILLOSCOPE TRACES photographed during test cuts with tools having shanks of SAE 1095 steel (top), copper-nickel-tungsten alloy (center), and solid K6 tungsten carbide (bottom), prove that amplitude of vibration, as expressed in strain of the overhung shank, is inversely proportional to the modulus of elasticity of the shank

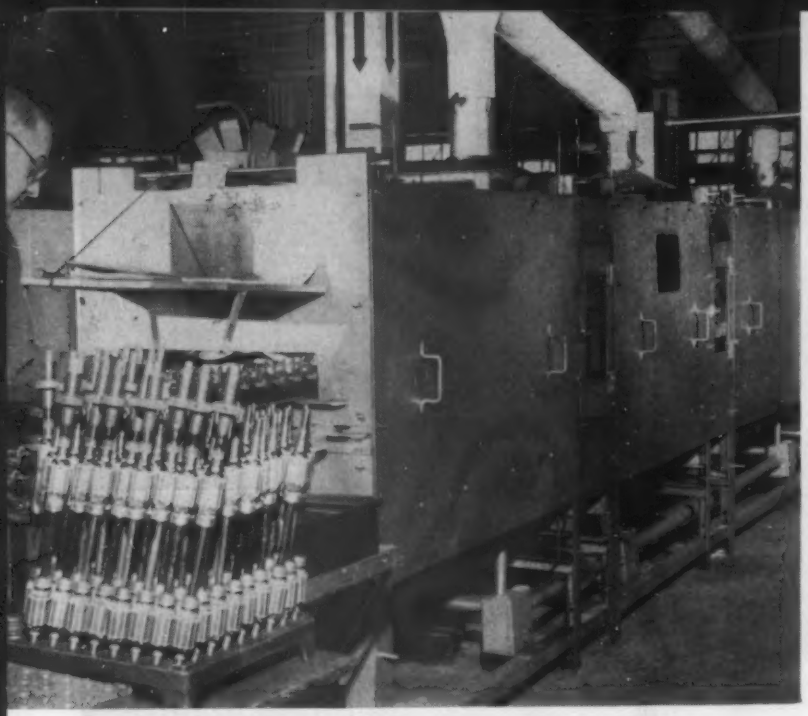
times that of steel, and over twice that of the heavy metal alloys) combined with a density (approx 14.8 gm per cu cm) almost twice that of steel, and only slightly less than the specific gravity of the heavy metals.

To evaluate these three groups of materials as tool shanks or bodies, a plunge-cut test was run on an engine lathe at the Kennametal plant, Latrobe. Tools having identical cutting edges, but using SAE 1095 steel, a copper-nickel-tungsten heavy-metal alloy, and Kennametal K6 cemented tungsten carbide as shank materials were tested. In addition, a similar tool having a common brass shank (approx 15,000,000 psi modulus of elasticity) was tested to provide a broad range of beam stiffness.

All the tools had ½-in.-square shanks and were ground with the same cutting-edge geometry. The solid Grade K6 tool was not tipped, the others had brazed tips of Grade K6 tungsten carbide.

The tools were successively mounted in a rigid, open-side toolpost with 1½-in. overhang, and each was fitted with an SR4 strain gage on the top surface of the shank. During each test the strain gage was connected electrically to an oscilloscope to record the reversals of strain caused by vibration developed in cutting. Under identical conditions of speed, feed, and width of cut, the oscilloscope curve was photographed after a predetermined time delay to permit the cutting action to reach equilibrium.

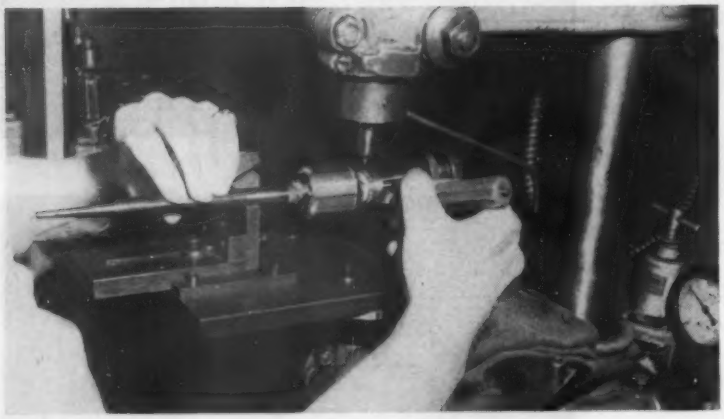
The tool with the brass shank failed before an oscilloscope curve could be established. As indicated by the accompanying reproductions of oscilloscope patterns photographed when using the other tools, the amplitude of vibration, or *chatter*, as expressed in strain of the overhung *beam* of the tool shank, was found to be inversely proportional to the modulus of elasticity of the shank material. The tool with a solid carbide shank showed an average amplitude of 2½ lines on the oscilloscope chart; the heavy-metal alloy shank averaged 7 lines; and the steel shank, which produced a much more irregular curve, averaged 9 lines.



Conventional impregnation . . .

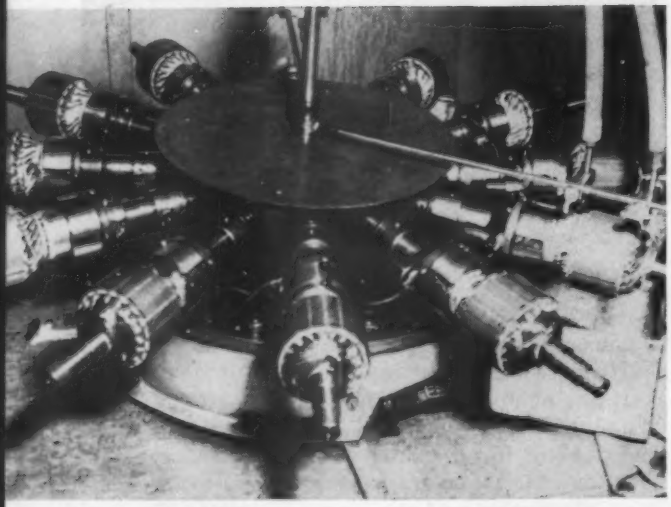
. . . of armatures with a solvent-type varnish is accomplished in a Zanderoll infra-red conveyor oven. Armatures are preheated and given at least two varnish treatments. Rolling the units allows deep impregnation of the varnish without coating shaft surfaces, thus eliminating any subsequent cleaning operation

SHOP SHOTS AT DUMORE



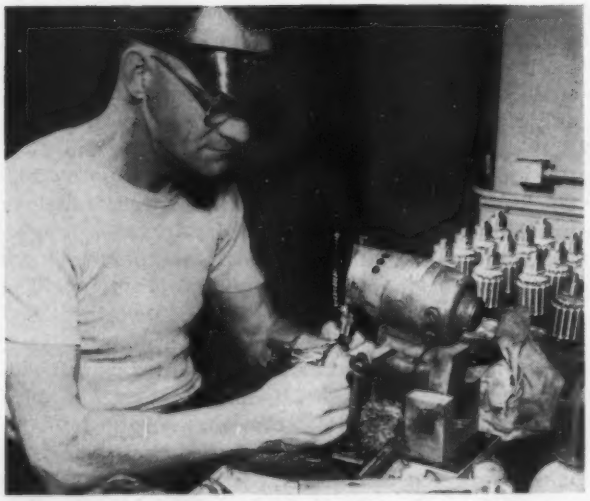
Solderless method . . .

. . . of attaching armature winding leads, 23-gage and smaller, to the commutator. Small cup-shaped tool, rotating at 30,000 rpm, is brought down astraddle the commutator-bar slot holding the two lead wires, locking them firmly into place. Prior removal of insulation from the wires is not necessary in this patented process



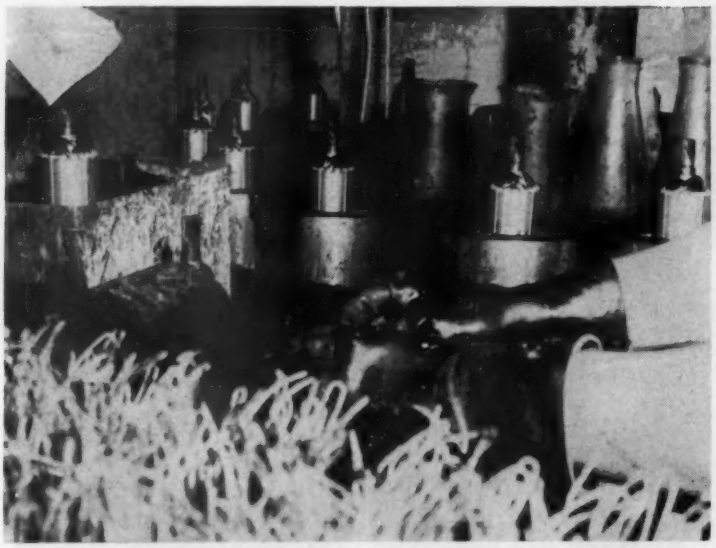
Special Laminac process . . .

. . . presently used on one size armature only, involves dripping polyester resin on the windings as the armatures rotate and are simultaneously heated by passing current through their windings. Twelve-station unit indexes every 1¼ min, using two stations for resin application, remainder for curing the solvent-free resin



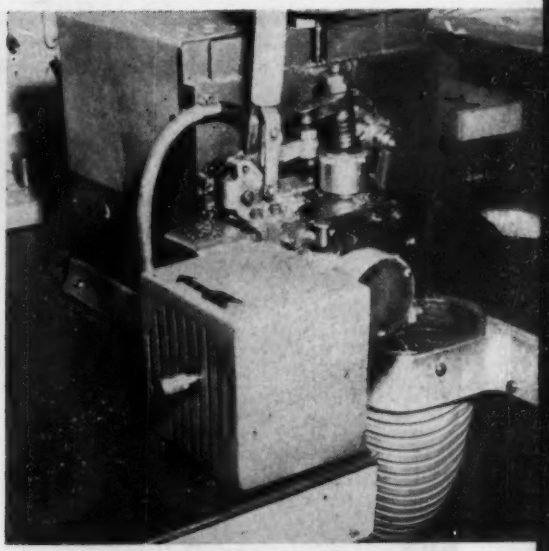
Heavier-gage wires . . .

. . . are connected to commutator bars by a rapidly vibrating tool driven by a cam mounted on a Dumore motor. This hammers the bar down around the lead wires with relatively light blows, simultaneously cutting off the excess wire. This holds the wires in place mechanically, and an excellent joint is effected by subsequent soldering



Removal of film . . .

. . . insulation from magnet wires is achieved by placing armatures in individual stainless-steel containers filled with a stripping acid. Containers are rotated on a turntable with speed adjusted to cycle time required. Motor-driven brass wire brush is then used to clean the loosened film from the wires

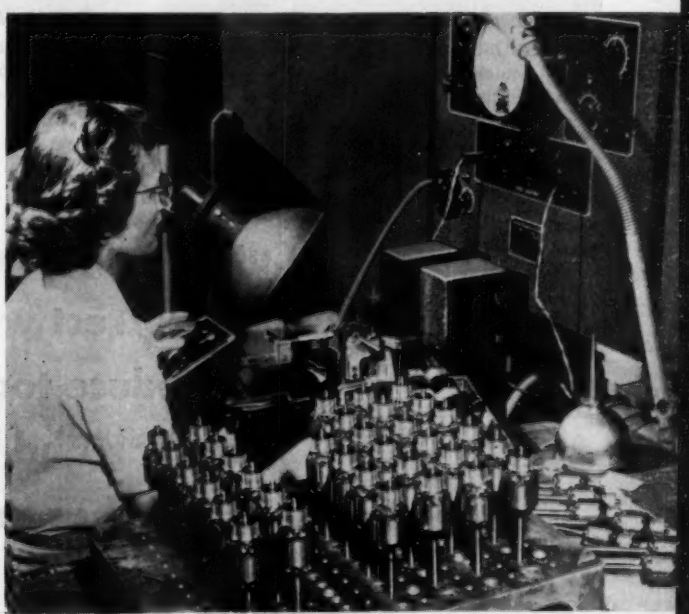


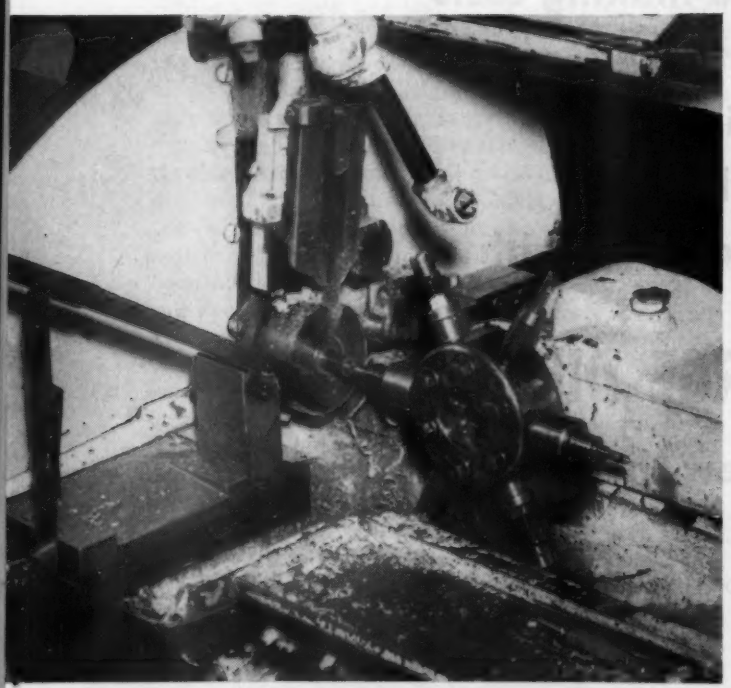
Automatic machine . . .

. . . built by Dumore, slots commutator bars. Work is held by spring-loaded toggle clamp, and the machine indexes automatically for the required number of slots, then stops. An interlock prevents starting the milling cutter unless work is securely clamped. Machine is adjustable for different sizes and different numbers of bars

Before assembly . . .

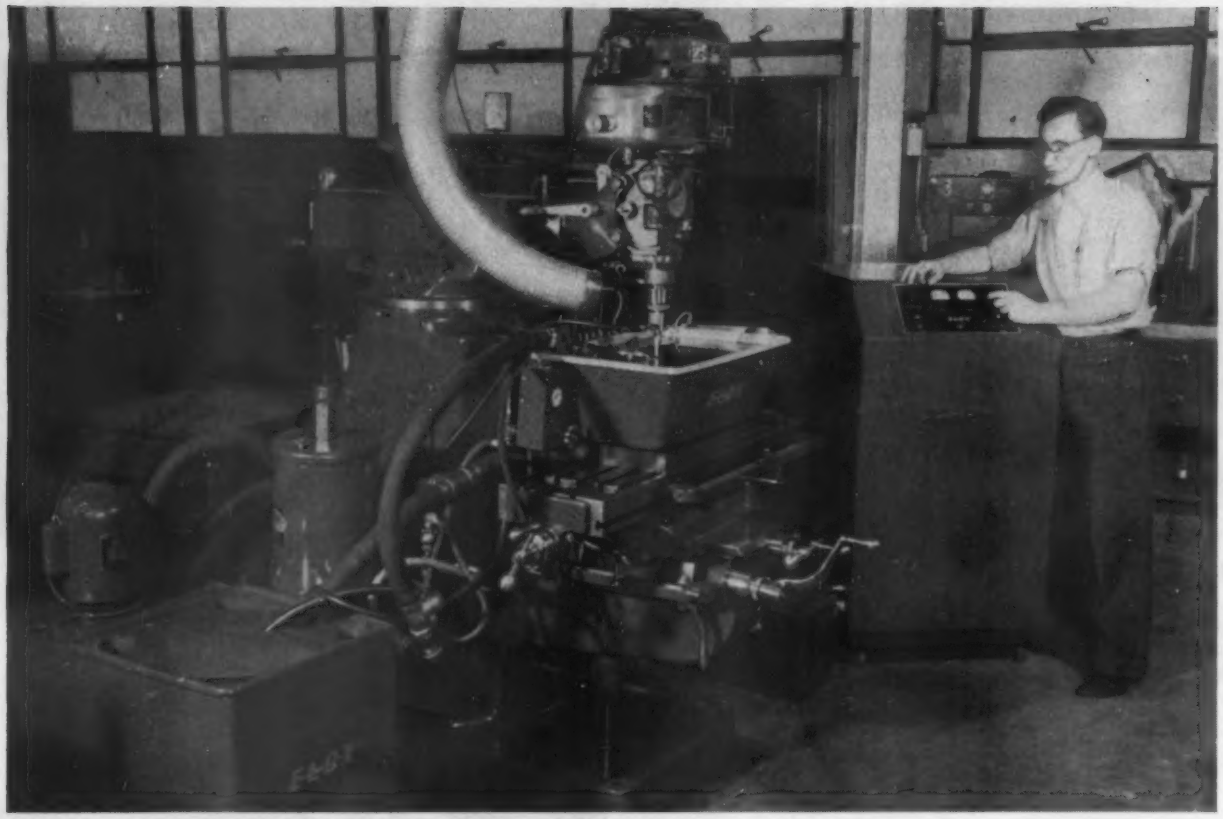
. . . all armatures are dynamically balanced to a high degree of precision on a Gisholt Dynetric balancer. Amount of correction required is indicated by a meter reading, and the location of the unbalance is given by a stroboscopic light flashing on a numbered paper strip





Machined and broached . . .

. . . brass sleeves for brush holders are fed by gravity chute, picked up by inserting tool, and pressed into partially machined bakelite tube. All machining on the bakelite is done on this No. 2G B & S automatic which also finish machines the brass sleeve after insertion. Two complete holders are made at each full turret index. OD machining is done with rear cross-slide, cutoff with vertical cutoff attachment



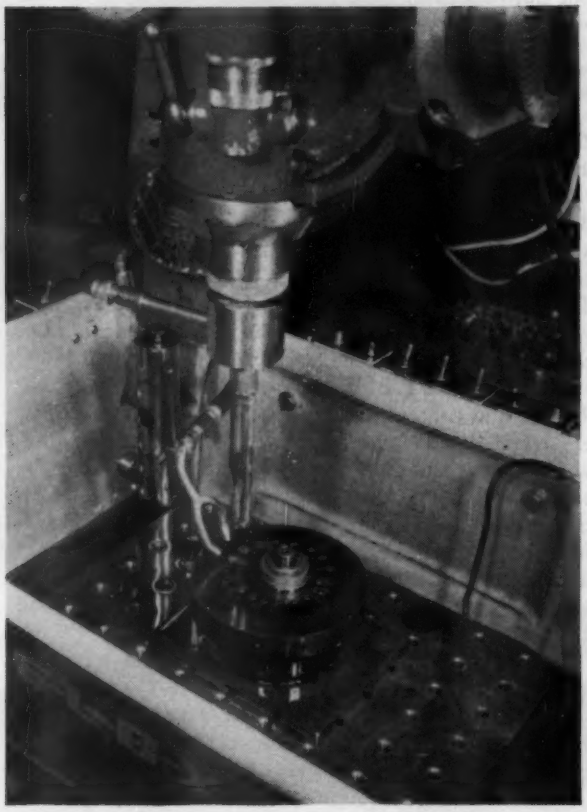
PRECISION DIESINKER, specially converted for electrical-discharge machining, has made possible major savings in time and skill required to revise mold parts to suit engineering changes. Where possible, electrode is rotated to improve cutting speed and finish. Diesinker spindle is locked when shaped electrodes are used

- **Modify existing tools**
- **Cut die- and mold-making costs**
- **Salvage incorrect work**
- **Reduce tooling time**
- **Save diamond wheels**
- **Drill, mill, shape, hard materials with . . .**

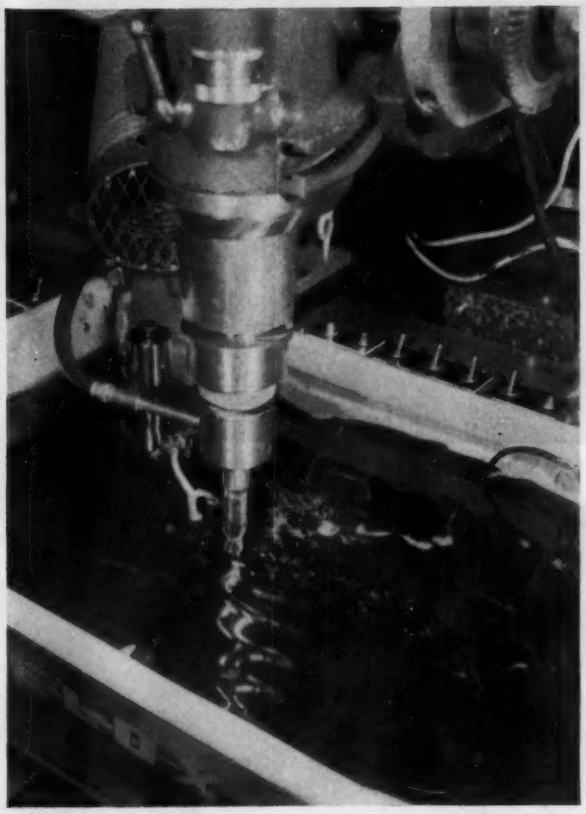
ELECTRICAL-DISCHARGE DIESINKER . . .

a new shop tool

GEORGE L. WEISER, asst chief engineer
DELCO-REMY DIV. GENERAL MOTORS CORP. ANDERSON, INDIANA



WORK IS CLAMPED to drilled-and-tapped table inside tank which contains dielectric coolant during cutting. Ideally, electrode is not drilled to pass coolant to cutting area; nozzles are used instead



CONSTANT AGITATION of coolant in tank on machine table is caused by rapid flow from nozzles. Before reuse, coolant is filtered to remove particles carried from part during spark cavitation

Conversion of a light-duty, precision diesinker to use electrical-discharge machining procedures (*AM* —Mar 3 '52, p136, and Mar 15 '54, p137) has in many instances made it possible for us to materially reduce the time and cost required to produce or revise cavity inserts for diecasting and plastic molds. We also have used this equipment to achieve major savings in the production and repair of both cemented-carbide and hardened-steel blanking and forming dies used to make automotive electrical equipment.

Even though the machine has been in use for only a little more than six months, important savings have been achieved in revising mold and die inserts to suit changed part drawings. In one case, the equipmen was used to add two 3-step holes in each of six hardened-steel diecasting-die cavities. These holes were finished to required accuracy in 48-hr of machine time, using the electrical-discharge equipment, without it being necessary to anneal the cavities prior to machining. New cavities would have required 4200-hr of expensive diemakers' time—and chances are this would have been necessary if the electrical-discharge unit had not been available. Annealing and rehardening of these cavities would have been extremely difficult, if not impossible, to complete without damage to the cavities.

In another case involving hardened-steel parts, it was necessary to lengthen a counterbore 0.050-in. in eleven mold cavities. Engraving by conventional procedures would have required 33 hr, plus the cutter cost. Only 12-hr of machine work was needed to finish the eleven counterbores by electrical-discharge procedures—a saving of 21 hr.

Reductions in man-hour requirements are equally impressive when it is necessary to revise cemented-carbide die and mold parts. For example, it was necessary to increase the bores of 15 carbide-lined bushings from an original ID of 0.750 in. to various sizes ranging from 0.923 to 1.162 in. The carbide liners were ¾-in.long in six of the parts, 1⅝-in. long in the other nine parts. Grinding with diamond wheels called for 170 man-hours, plus $300 in wheel cost. Using electrical-discharge equipment—production of brass electrodes required 36-hr, and the holes were enlarged in 54-hr of machine time, a total of 90 man-hours. Man-hour savings totalled 80 hr in addition to the savings of $300 for diamond wheels, less the small cost of the brass used in the electrodes.

One of the outstanding jobs done with the electrical-discharge unit involved the revision of four diecasting cavities for the 1955 Chevrolet tail light. An engineering change made it necessary to sink a 0.190-in. deep and very narrow, channel around the outside contour of the cavities to form a light-de-

TAIL LIGHT ASSEMBLY bases (left) were produced in four cavities which had to be changed to provide the improved base (right) by adding a light-reflecting rim around the outside contours. Cavities could not be annealed for re-machining, hence electrical-discharge method was used

ELECTRODES for changing tail light base diecasting cavities were machined from 65-35 brass castings. Previously diecast parts were used as masters on a tracer-controlled duplicator, making necessary allowance for shrinkage. Eight sets of electrodes were used

ONLY 20 HR WERE REQUIRED to make the electrode and sink 0.500-in.-deep slot, 0.895-in. wide, in end of experimental cavity for molding a battery-terminal shield. Slot had a 1½° taper on each side and a blended 0.016-in. radius at the bottom. Estimates were 48 hr to endmill this slot, and that many small, expensive endmills would be broken in the hardened toolsteel part. Polishing, after electrical-discharge machining the slot, required only 3 hr

flecting rim around the castings. It was estimated that these channels could be machined with a duplicator in approx 300 hr, if the cavities were not hard. But new cavities would have cost more than $10,000, and annealing, rehardening, and repolishing was not considered advisable. Some 200 hr was spent in developing and contructing eight sets of electrodes, two for each cavity—then the cavities were machined in 50 hr by electrical-discharge methods.

We still have a lot to learn about proper electrode design, and correct procedures to follow, when using electrical-discharge equipment. Not all of the jobs we have tried have proven practical or economic. In some cases electrode cost has been excessive, in others machining time has been too long. But we have gained important knowledge about the process and its possibilities while using the unit in our mold and die shop—and we believe the process has good possibilities for broader future savings.

Among the factors that now appear to have importance are:

1. A good flow of *clean* dielectric coolant is essential. If the fluid used becomes dirty, cutting action is materially slowed down. After some experiments with different oil coolants, an oil having a dielectric strength of 29,000 volts at 0.100 in. was selected. This oil, in the opinion of the machine operator, increased cutting efficiency 100% over that possible with the oil originally used. An efficient filter of adequate capacity should be used to keep the cooling oil clean as it is constantly circulated by pump.

2. Tin-free brass must be used for the electrodes —tin in the brass alloy appears to slow down cutting action materially. On the other hand, inclusion of lead in the alloy does not appear to affect cutting action. Best results, to date, have been achieved when using brass of approx 65% cu, 35% Zn alloy. The electrodes should be annealed for best results.

3. The larger the area of the work covered by the electrode, the faster the cutting action.

4. The harder the metal being cut, the faster the cutting action. Other factors being equal, cemented carbides can be machined 15 to 20% faster with the electrical-discharge process than can steel of 56 to 60 R_c hardness.

5. High cutting speeds are not always desirable. Best finishes are achieved with slower cutting rates.

6. Drilling of electrodes to direct flow of coolant to the cutting area is not essential, if it is possible to cause the dielectric oil to flow freely through the gap between the electrode and the work.

7. On straight work, as when "drilling" straight, round holes, or when "milling" flat surfaces, it is desirable where possible to rotate the electrode, and to gash the electrode surface to provide an "interrupted" cut. This both improves cutting action and increases flow of coolant through the gap between the electrode and the work.

American Machinist

SPECIAL REPORT NUMBER 406

TOOLING AND METHODS IN

The World's Biggest Job Shop

Immediately after World War II, the General Electric Company began planning a new 22-acre, $30,000,000 plant in Schenectady, NY, for the production of large steam turbine-generators, adding capacity and combining operations formerly in several older buildings. In 1954, the fourth year of production, annual output had almost tripled over the original estimated manufacturing capacity of the new building. Such achievements require scheduling, planning and tooling that are exceptional. Here the editors of *American Machinist* show outstanding operations and methods that make such production efficiency possible.

TAKEN FROM THE VISITOR'S GALLERY, this view of one bay gives some idea of the building's size. There are a total of nine manufacturing bays and a 3-story, 40-ft-wide service bay, each 1400 ft long. Two of the five high bays are 80 ft wide; the other three 70 ft wide. The remaining four low bays are each 60 ft wide

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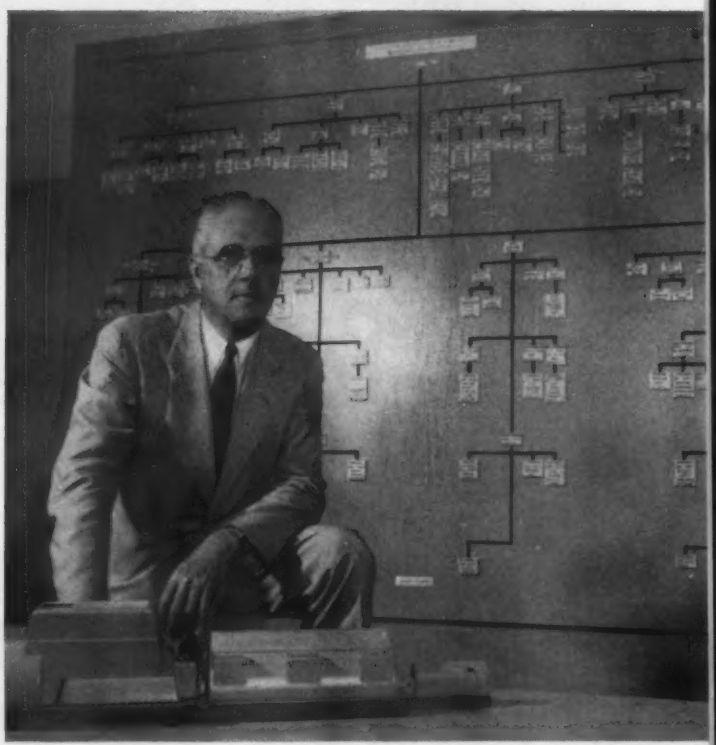
MANAGEMENT:

- ***How is the turbine-generator manufacturing team managed?***
- ***Who calls the plays in a 4600-man specialty "job shop"?***
- ***How do you coordinate men and machines?***
- ***What steps maintain high quality?***
- ***Where does management find the time to supervise all these operations?***
- ***When do you change the play to win the game?***

For the answers to these questions, you must first understand the organization. Here is an example of decentralization in a large company



ORGANIZATION must be carefully detailed to handle 4600 men effectively. Here Will Pruessman, manager-manufacturing, stands before the organization diagram for his section. The upper line shows key men of the five functional sub-sections, the lower of the four operating sub-sections. Organization within each operating sub-section is a smaller-sized duplicate of the over-all

"Pinpoint the responsibility." This is the basic principle in the decentralization program at General Electric sponsored by Ralph J Cordiner, president. Each executive has a clearly defined job and responsibility. This is nowhere better illustrated than in the Large Steam Turbine-Generator Department in Schenectady.

Robert Paxton is executive vice-president of the Apparatus Group, and Glenn B Warren is vice-president and general manager of the Turbine Division, which is responsible for the manufacture of all types of turbines except aircraft gas turbines. William E Saupe is the general manager of the Large Steam Turbine-Generator Department, with total authority within the limits of General Electric Company's over-all objectives, policies, and budgets. He operates the LST-G Dept as though it were a separate, private company.

The LST-G Department has five major "Sections": Engineering, Manufacturing, Marketing, Finance, and Employee Relations. Here we are primarily concerned with the Manufacturing Section, headed by Will Pruessman, manager-manufacturing. Operation of the section is on a modified line-staff basis.

Within the Manufacturing Section are five functional sub-sections, each with a manager, and four operating sub-sections, each under the direction of a superintendent. Services include: Manufacturing Engineering, Materials, Factory Maintenance, Quality Control, and Manufacturing Administration & Personnel Development. Operating sub-sections include: Machine Shop, Buckets & Diaphragms, Control, and Winding & Erection. The person in charge of each sub-section reports directly to Mr Pruessman. Functional sub-sections are responsible for over-all planning and may advise and counsel operating sub-sections, but may not dictate to them.

Under the superintendents are general foremen and foremen in charge of the various factory operations. With approximately 4600 employees in the Manufacturing Section of this plant, there are never more than three levels of management between each employee and the manager-manufacturing.

For the man who is used to the operation of a smaller job shop or the manufacture of large quantities of similar standard items, coordination of production flow in a shop of this size may seem a formidable task. Each turbine-generator contains thousands of parts, some standard, while many others have specific requirements to suit the particular conditions of an installation. Parts range in size from a fraction of an ounce to over 200 tons, and tolerances are frequently within 0.001 in.

SCHEDULING

Let's follow the path of a normal turbine-generator order. This arrives at the Large Steam Turbine-

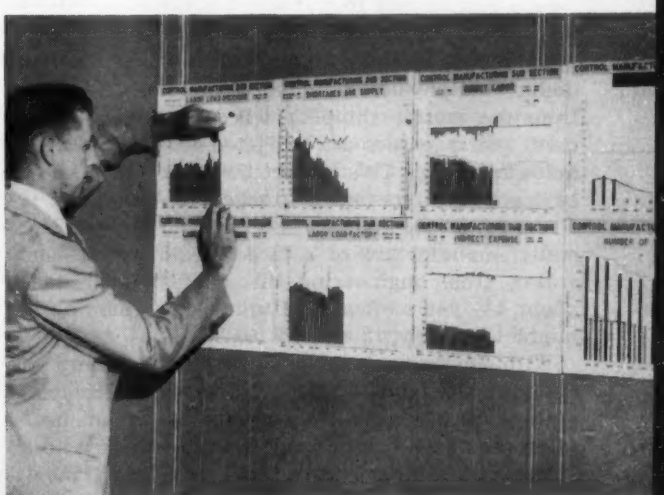
POWER HOUSE, NOT POWERHOUSE, might best describe this huge plant which is capable of adding approximately seven million kilowatts per year to the nation's electrical capacity. Within these walls, 6000 people design, build and market giant steam turbine-generators that supply electric power for home and industry. Building is 1400 ft long, 650 ft wide, and 120 ft high; contains 22 acres, or over 1,000,000 sq ft

Generator Department as a requisition from a district sales office. It goes to the manager-materials, who enters it on the master shipping schedule.

The master schedule, which indicates shipping dates, is then checked against manufacturing cycle charts which have been prepared in advance for various types of units, to determine engineering, materials, and manufacturing dates. By comparing the master schedule against the manufacturing cycle charts, the manufacturing section determines the number of weeks before the shipping date that engineering instructions, materials, and processing are required. Also a list of parts to be drawn from stock is prepared and checked against the inventory.

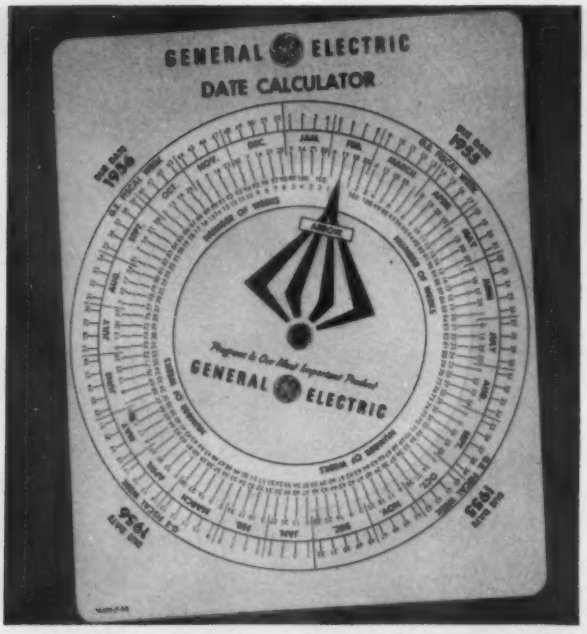
Some shops schedule ahead by calculating the time required to produce each piece and the time for assembly and test; then juggle these factors to arrive at the required shipping date. At the LST-G Dept, scheduling is done backward from the shipping date, and this date is the key to preparing the entire manufacturing schedule for all parts.

One reason for this procedure is that the customer usually specifies when he wants delivery, which may be as much as three or four years away. Another reason is that, using the shipping date as the criterion, all phases of manufacture can be coordinated to meet the shipping-date bogey. This is particularly true for jobs where most of the parts must be made



VISUAL REPORTING is faster, more effective than complicated tabular reports. Trends and exceptions are readily spotted with a minimum of study. Key factors can be closely watched and readily compared, for fast overall analysis of a condition. Here W P Dillon, specialist, manufacturing control data, is updating the ten key "weekly management measurement charts". These charts are used by the superintendent for his weekly meetings with his own supervisors, and for his monthly review with the manager of manufacturing. Charts include: labor load-ordering, shortages and supply, direct labor, safety record, manufacturing losses, labor load-planning, labor load-factory, indirect expense, number of workers, and cost reductions

HOUR CALCULATOR was designed to speed scheduling and minimize errors on continuous 3-shift operations. Hours are printed in black in clockwise direction, red in counter-clockwise direction, on center disk. Latter is mounted on base card which contains hourly breakdown of days. *Completion hour* for job is determined by setting arrow opposite starting time; then reading black numbers clockwise for the given number of job hours, opposite which is the day and hour on which the job should be finished. *Starting time* is found by reading red numbers counter-clockwise from desired completion hour, again using total number of job hours



DATE CALCULATOR is similar to hour calculator; is necessary because so much of the work is figured in terms of weeks to the completion date. Divided into 104 weeks (2 years), this little device is a considerable improvement over counting on a calendar

to a specific order, rather than drawn from stock.

Two major requirements for any job, financial dollars and physical production, are also determined from the master shipping schedule. Thus, money, men, and machines are budgeted for each phase of manufacturing. This budget includes the dollars to be spent on direct and indirect labor, direct and indirect materials, and any other special charges. Normally, manufacture of a large steam turbine-generator, from engineering through shipment, takes about 1½ years. A second unit of the same design might take only 12 months to build.

With the expense and facilities requirements established, individual orders are prepared, complete with blueprints, specifications, and operation sheets, for each part in the turbine-generator. Parts to be manufactured are ordered on a simplified standard form—a 3 x 5-in. shop order which authorizes the holder to obtain material and manufacture the part. A similar slip authorizes purchase of special items. Stock items are maintained on a perpetual-inventory basis, and parts in this category are requisitioned from stock; accumulated against the job.

From the manufacturing cycle charts, and these individual orders, expediter's progress lists are prepared, initially, and sent to the dispatch cages, which are located in each manufacturing area. These lists itemize every order to be completed, *indexed by starting date*. Jobs are started from the top of the list first, the earliest starting date, and as one job is completed, the highest open job on the list is started. Thus, the hottest jobs are always on the top of the list, followed by the later or next-to-run jobs. New lists are issued as often as required, even every day if necessary. Late jobs appearing on the previous day's list are reported for action.

A similar, but abbreviated, list is sent to the superintendents of the four operating sub-sections, where they are further subdivided and distributed to the general foremen and foremen. Hence each level of responsibility knows what portion of the total order he must fill and when it is due. From these lists, individual-group-production progress charts are prepared. Some of these are tabular, others graphic. A form of Gantt chart is recommended because its graphic nature shows clearly at a glance the status of each shop order in progress. However, this form is not mandatory. Each supervisor may use any system that he feels best suits his needs, provided that *his jobs are on time.*

Based on the individual shop orders and the manufacturing cycle charts, tooling is planned for each piece to be manufactured. Both the methods and the tooling are discussed with Manufacturing Engineering which makes recommendations as to new techniques and improved procedures as well as advises on the most suitable methods for working new and difficult materials. Then, in cooperation with the operating sub-section which will use them, the tools are designed by Manufacturing Engineering and built in the Tool Room. Tool scheduling is based

upon the starting date of the part for which the tool is to be used, in the same manner as the parts are scheduled from the shipping date of the completed turbine-generator. Tools are started in time to have them ready when Production needs them.

HOW DOES THE LOAD BALANCE?

Without internal coordination, a shop of this size would quickly be in chaos. If one person tried to watch everything in detail, nothing would be accomplished. That is why two concepts are extremely important. First, the concept of "confidence instead of control" places much of the responsibility for getting the job done directly in the hands of each echelon of supervision and even into the hands of the working force. In this way, all of the many things to be watched are shared by a large number of people and no one person is intentionally overloaded to the point of inefficiency.

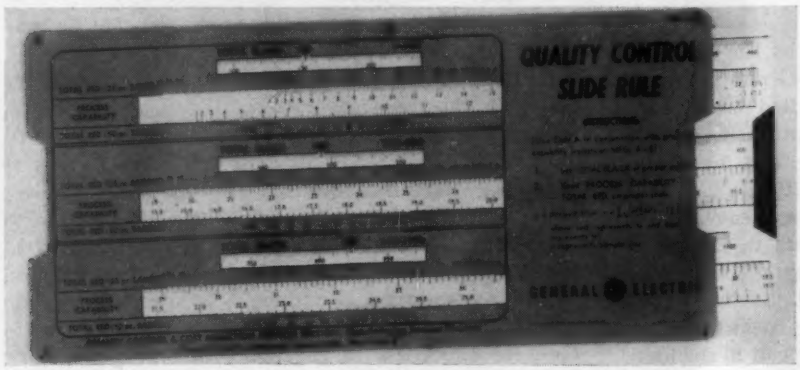
The second concept correlates with the first. It is called "management by exception." This phrase simply means that if a manufacturing program is set up to operate on schedule, the part of the program that stays on schedule needs very little management attention and more effort can be devoted to deviations from the schedule, or the *exceptions*. Degrees of exception are established so higher levels of management are forewarned as a condition becomes critical. This system requires good production planning and an effective operational reporting system. It gives management more time for trouble-shooting and to improve operational techniques; it avoids wasting time watching success. An "exception" is most frequently a job that falls behind schedule or an excessive expense, but not always. Jobs far ahead of schedule, or expenditures far below budgets are also exceptions to be watched; may mean that another phase of the program is suffering, that quality is poor, or that some overlooked task will not show up until the need for a part becomes critical. A low labor expenditure now might indicate that too few men are on hand to complete the job on time or that excessive overtime will be needed later.

Feedback is the "see" function of the triangular plant-do-see relationship essential to the success of any business operation. In a physical sense, it is quality control. In administrative terms, it is efficient reporting-back. You plan a task, then you do the work. Finally, you watch the progress to see that the work is going according to the plan and compensate for errors, or deviations from the plan. Feed-forward is another improvement on the system that has particular value for "looking ahead," especially for long-range projections. One way is simply a projection of the current status to show the effect of a deviation now on the future status of the job, either at some more advanced stage of completion or on the shipping date. For instance, a loss of only two hours at the end of the first week, if allowed to accumulate every week, can mean missing the shipping date by 100 hr or more by the end of a year. Actually, calculating these trends is somewhat more complicated than this example. Nevertheless, failure to weigh in this factor has made a lot of manufacturers think they were in the black until too late to correct an overwhelming error.

A production progress chart, based on the Gantt principle, provides at a glance the detailed status of every major job in the shop. Transparent plastic film contains colored strips of cellophane tape to denote each element of major assembly. Strips are cut in lengths to indicate time required for each task; then tape is removed as job progresses. Vertical lines on the chart show current week and jobs more than several weeks late for various units in work are clearly apparent.

As manager of the manufacturing section of the LST-G Department, one of Mr Pruessman's important responsibilities is maintaining control of the manufacturing budget in terms of specific and overall goals. From the immediate figures and the trend of expenses related to the individual-program budgets and the total plant budget, plus the manufacturing cycle charts, he can determine with considerable accuracy the degree of manufacturing progress. Most of this information comes to him in a single, graphic, regular report. Because he knows exactly where and how the dollars are being spent, he can concentrate on the deviations from the budget and maintain a balanced operation.

Once each month, Mr Pruessman holds a staff meeting of all his managers and superintendents at which problems, ideas, conditions, weaknesses, and the like can be discussed. He also has a regular



QUALITY CONTROL SLIDE RULE was developed by the Quality Control & Cost Reduction Services Section of General Electric's Manufacturing Services Division; is used to reduce the time required for mathematical calculations, to minimize computational errors, and to encourage greater use of a few of quality control's statistical techniques. Side A of the slide rule assists in determining the quality capabilities of machines and processes by providing total capability as 6σ. The upper portion of the side *B* is used to calculate control limits for average percent defective charts and the lower portion is used to determine standard deviation, using the formula R/d_2. This slide rule is for GE internal use only; is not for sale

monthly meeting, privately, with each manager and superintendent to give his supervision a chance to discuss problems, air personal feelings or ask advice. Each of these people, in turn, meets similarly with the supervision reporting to him. Hence, integration is not as difficult as it might seem.

"JOB-SHOP" QUALITY CONTROL

Control of quality, when parts are "as big as a house" and yet must be held to extremely close tolerances, is an exacting job. Quality control engineering, inspection, and test are combined into a single sub-section of the manufacturing section.

Most manufacturing in the LST-G plant, particularly the big pieces, has been on a 100% inspection basis. A few of the quantity parts have been inspected on a sampling basis.

Because dimensional accuracy is so critical in these precision products for power plants, many of the pieces are inspected a number of times before they are shipped. The first inspection, usually, is by the machine operator. He checks the previous operation and then he inspects his own operation when it is completed. Next the operator calls a floor inspector who makes out a report if errors or substandard work have occurred.

Even with all these checks, every unit is assembled and factory tested. Some components are pressure tested, spin tested, etc, before assembly. After assembly, each steam turbine and generator is tested at operating speed; then is completely disassembled and each sub-assembly is inspected again as the parts are prepared for shipment.

Recently, statistical quality control has been applied. This type of control is normally considered for mass production only, but it appears to hold tremendous potential for job shops as well as many other shops producing "one-of-a-kind" parts.

Some of the newer concepts of quality control being applied include:

1 . . Quality cost analysis
2 . . Process capability studies
3 . . Machine capability studies
4 . . Quality audits and ratings
5 . . Statistical control charts
6 . . Sampling inspection

This information is being gathered by the Quality Control Engineering staff of the LST-G plant. Quality cost analysis will provide a detailed tabulation of the cost of maintaining consistent optimum quality for every operation, process, method, and machine.

Process, or man-machine, capability studies are being done to determine what tolerances each man-machine combination can be expected to hold repeatedly in normal practice; also the effects when these limits are tightened or loosened. Surprisingly, very loose tolerances do not always mean greater output. Beyond a certain point, they can mean loss of control and it is better to specify narrower limits even though they are not mechanically necessary.

PICTURED . . .
on following pages are some of the machine operations and techniques used in this 4,600-man "specialty job shop," techniques and set-ups which play an important role in this plant's outstanding production record.

Process capability data, collected on a continuing basis, is expected to give tool and process engineers, as well as planners, specific facts for scientifically programming each job. This information will show "the best way," as well as a variety of possible other methods. Thus, except for emergencies, there should be no reason to assign a job to a machine that is incapable of providing the required accuracy within a normal operating time. Also, if a machine has trouble meeting its usual standard, maintenance or other corrective measures are indicated. This is extremely helpful in determining the need for replacing or adding a machine tool or a process.

Quality audits and ratings are being done on the final product as well as on certain components. These audits include an evaluation by both engineering and manufacturing personnel to make sure that product or component quality is "service-adequate."

Similarly, parts drawings and operational sequences will be analyzed to separate the practical from the impractical; the profitable from the unprofitable. Quality ratings will be assigned to each process so the result will be both within specifications and within the budget.

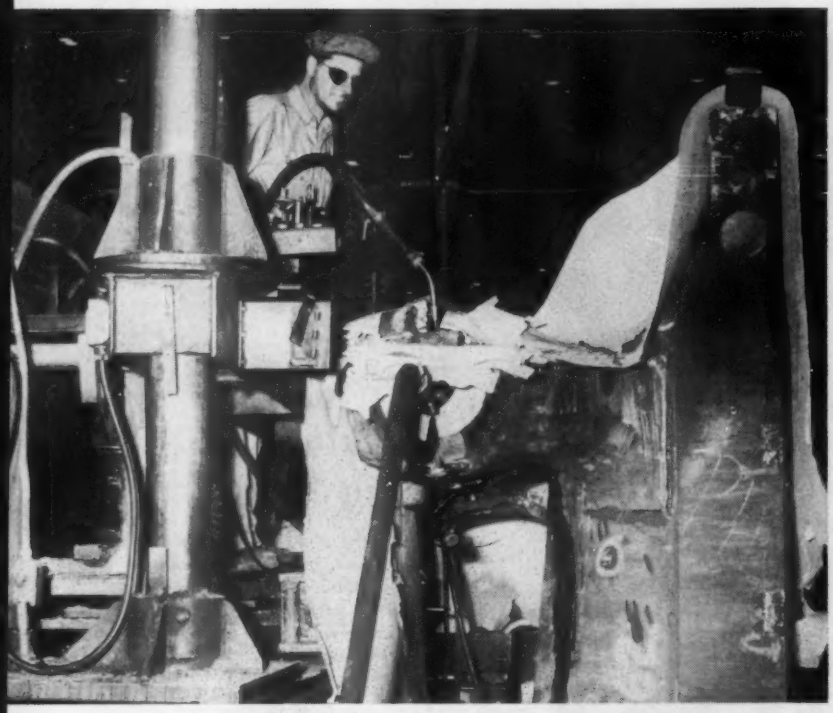
Information for this program will come from records on hand plus new studies. Three of these sources are a regular part of the Manufacturing Section's normal feedback:

1. Testing for functional ability of each operating component and the complete turbine-generator assembly, with detailed reports covering these tests.

2. Analysis of inspectors' reports to spot any possible troubles, such as operator's errors, specific machine conditions, and process defects.

3. Reports from customers and installation supervisors in the field, covering design, manufacturing, and efficiency of units.

Statistical quality control in the LST-G Department is still a relatively new concept and is subject to constant improvement. However, indications to date are that it can be as successfully applied to job-shop operations as it has already been applied to mass production. Further, it is one more tool to help achieve higher and more consistent quality in General Electric's large steam turbine-generators.



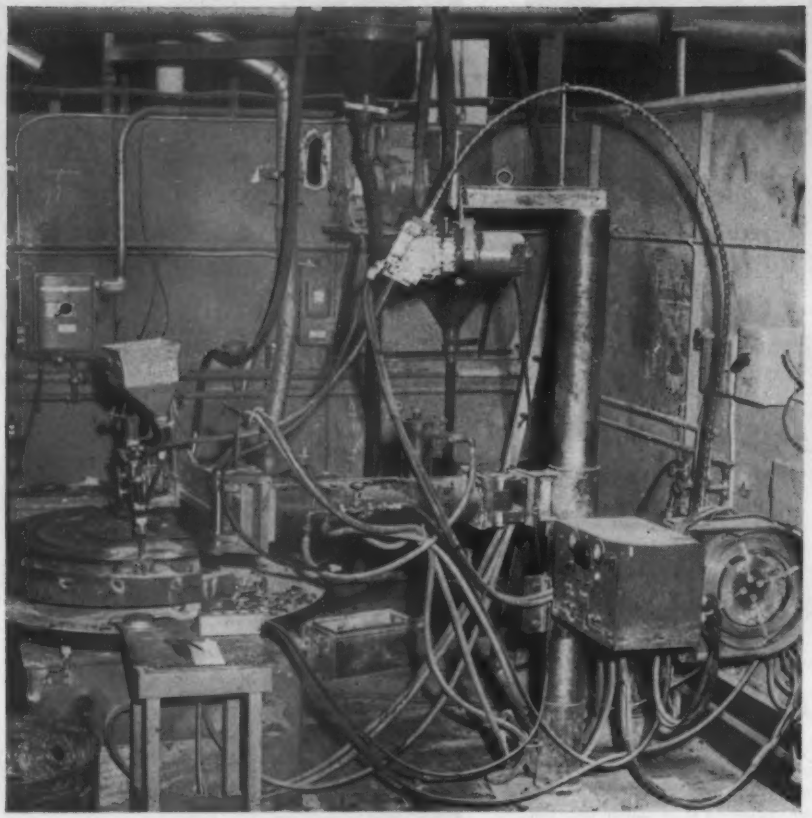
Complex shapes are built up . . .

Many large parts are assembled by submerged arc welding. Here a steam-chest top half is welded to a shell casting. This procedure avoids the complex coring for steam passages of a one-piece casting. Dissimilar metals may be joined, as well as cast metal to rolled or formed structures. "Paper" covering is of course asbestos, used to hold heat during pre-heating of parts by open gas flame — in this case from the burner underneath. The post at left supports the automatic welding head

Powder washing cuts out surface defects . . .

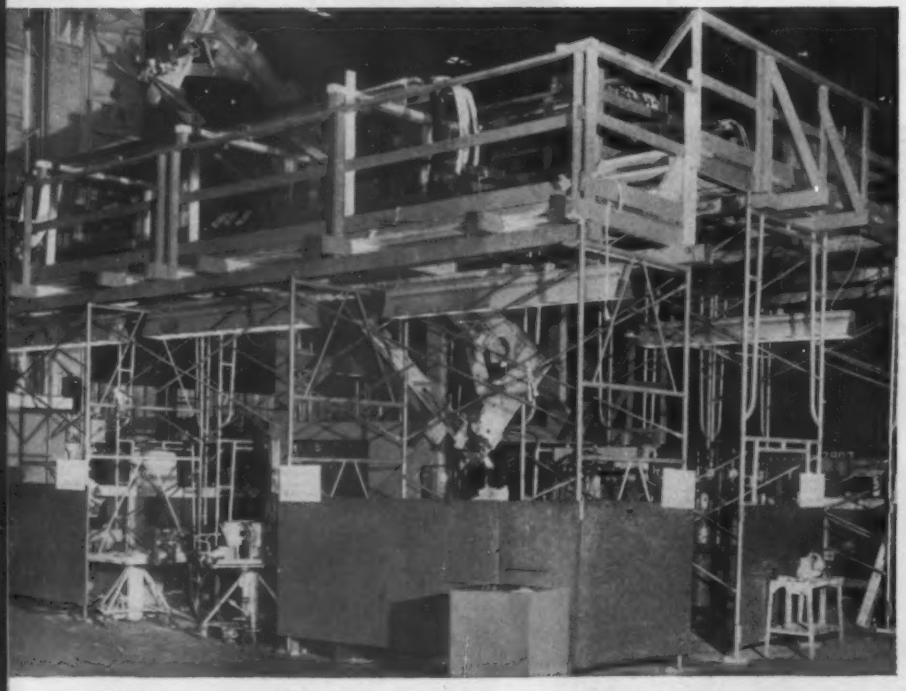
Surface defects in large castings are removed by powder washing — an oxyacetylene process in which a special powder is fed by air pressure to the blowpipe flame. By this process, as much as ¼ in. of surface can be removed per pass. The operator here is wearing aluminum-metallized clothing, a new protective device

Turbine-generator story...
continued in pictures



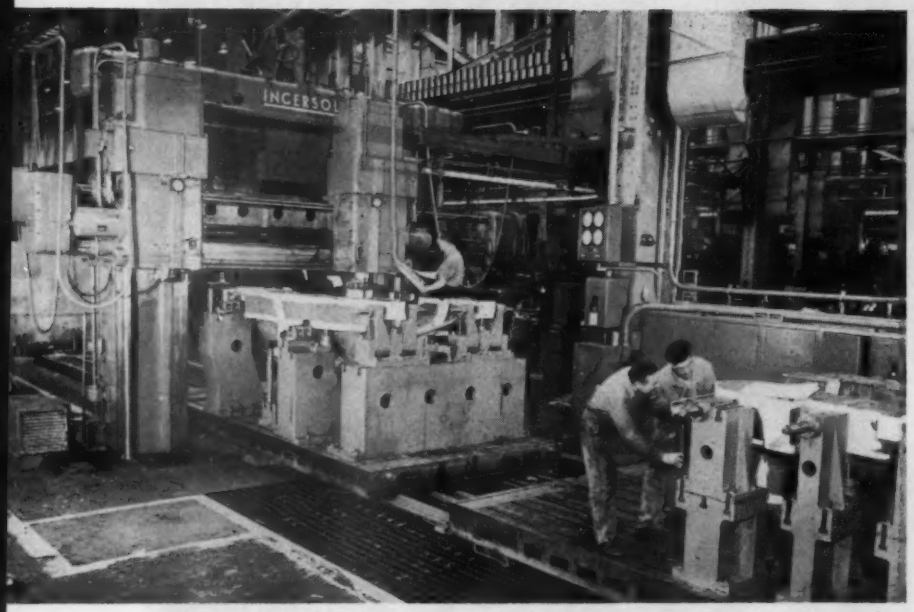
Automatic welding . . .

Nozzle diaphragms are welded by submerged-arc process on equipment built at GE from a combination of various manufacturer's parts. Rotation of work-table is automatic, and welding wire is fed from reel at extreme right



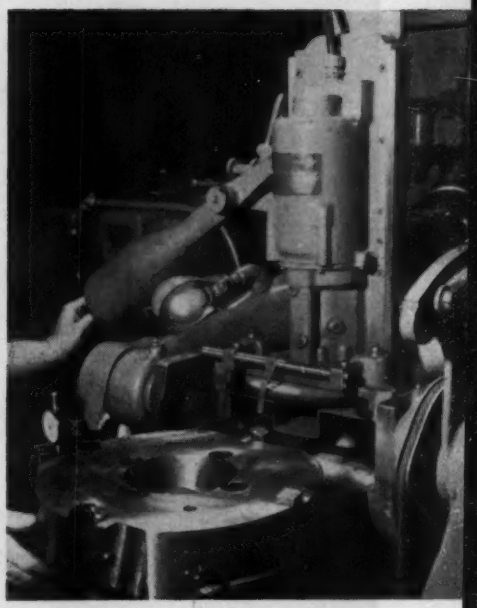
"Ferris wheel" for brazing . . .

Large armature bars are assemblies of exactly shaped copper rectangular wire (in this case rectangular tube so cooling liquid can be circulated). To save floor space and to ease manipulation, assemblies are built up on a wooden fixture — the big rotating arm — by working on the gallery, then the ends are swung down to the brazing area at lower right (closeup), clamped in a jig, and brazed



Two tables permit fast setup . . .

Two dual-table planer-type millers have already been installed and a third is on order. This one machines high-pressure-turbine outer and inner shells — irregular castings weighing 5 to 25 tons—to close tolerances. This is the 10-ft machine, with two 9 x 16-ft tables which can be joined to make one table 32 ft long. Two vertical heads and a horizontal head are provided, as well as a right-angle attachment. With this Ingersoll machine, and a micro-milling cutter, steam-tight surfaces up to 10 mu-in., rms, can be produced

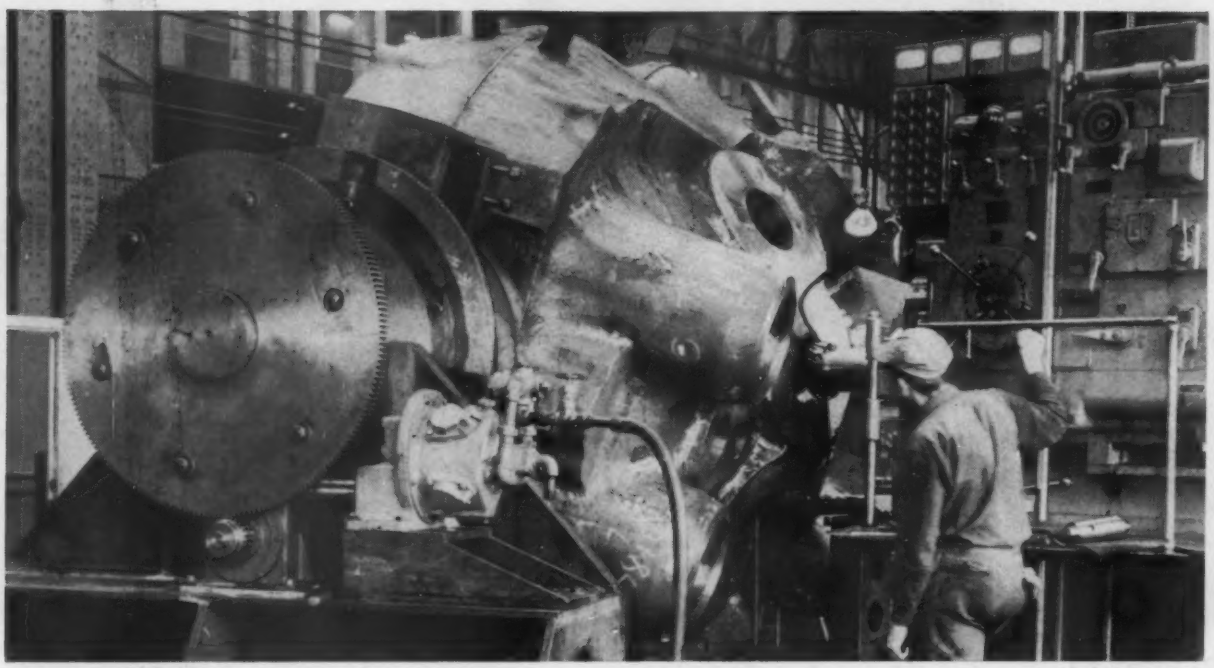


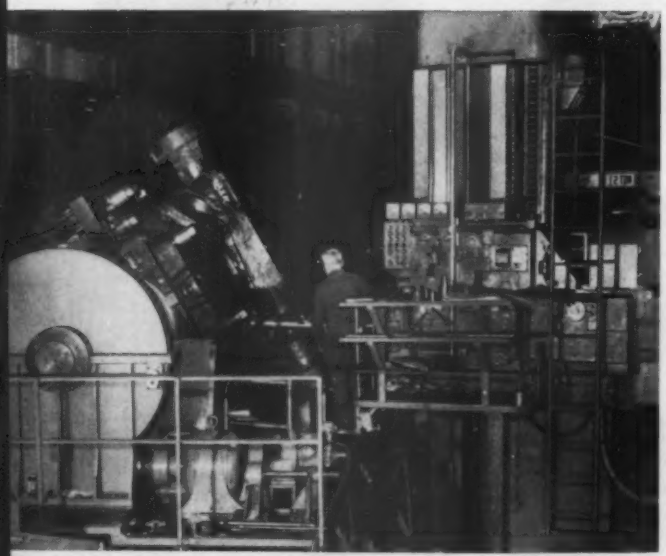
Regrind at home . . .

To minimize time loss and edge damage in cutter changes on the planer-millers, a cutter grinder is installed beside each machine, and a man is added to the day shift to handle regrinding. This makes a 3-man crew for two shifts, a 4-man for one

A private crane . . .

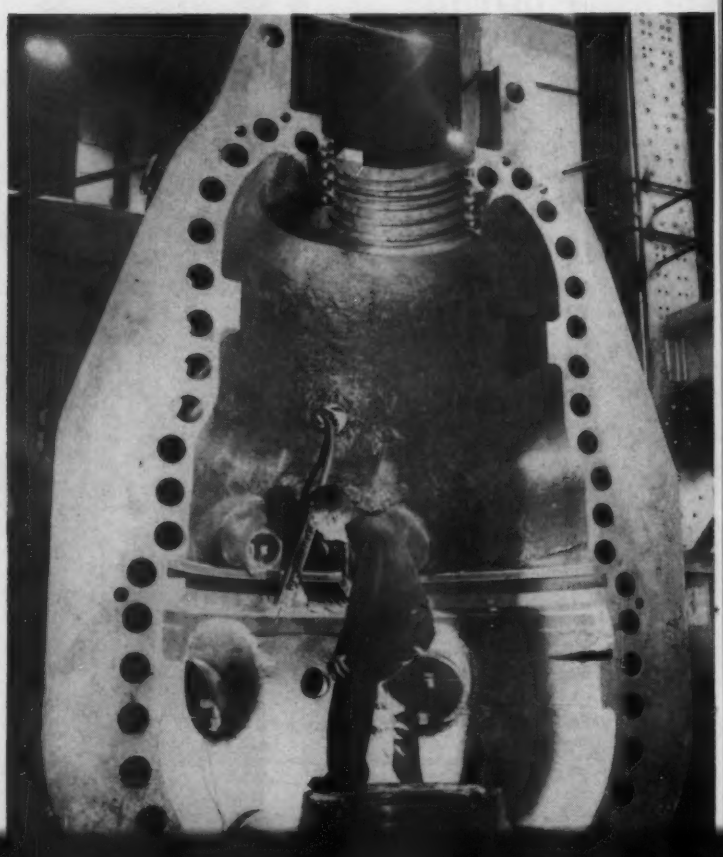
Here, from a crane, is the planer - miller arrangement on a new 84-in. machine. A special craneway and travelling crane are provided for job handling — found a worthwhile economy where every job is big and the machine area must be kept clear. One job can be set up while another is being machined, slashing non-cutting, hence non-productive, machine time. Chips are removed by an oscillating conveyor between the ways, which carries them to elevator unit and trucks at center right. Behind the chip conveyor is a cutter grinder because grinding cutters at the machine results in better work (see above). Cycle time on machining turbine shells has been substantially reduced, and several earlier machines are replaced by each planer-miller, justifying the large investment each represents





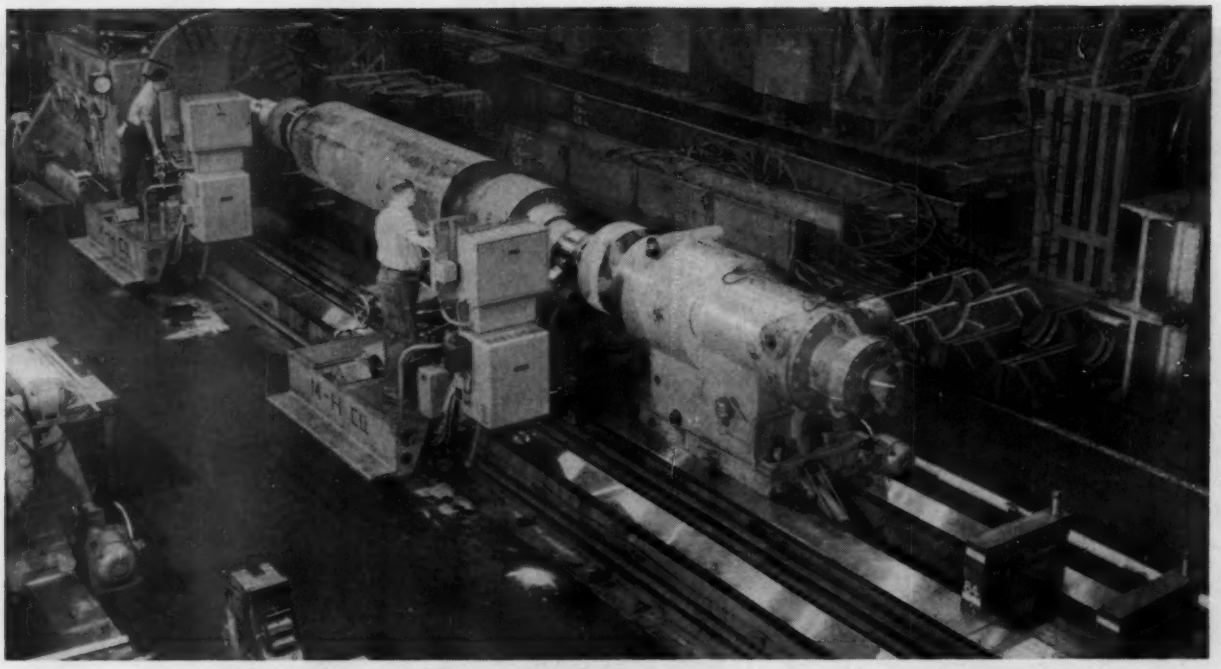
Setup for a tricky job . . .

Trunnion fixtures and horizontal boring mills working together handle many awkward jobs. This Giddings & Lewis horizontal has a rotary work support to increase flexibility. Here turbine inner and outer shells have been bolted together and are being bored simultaneously. Another type of fixture is shown in the photo of a similar job at left



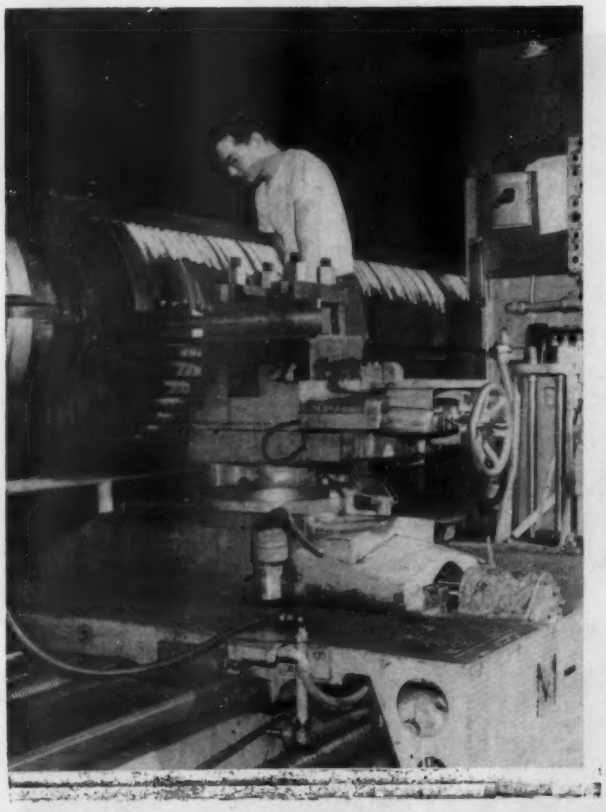
Blind machining . . .

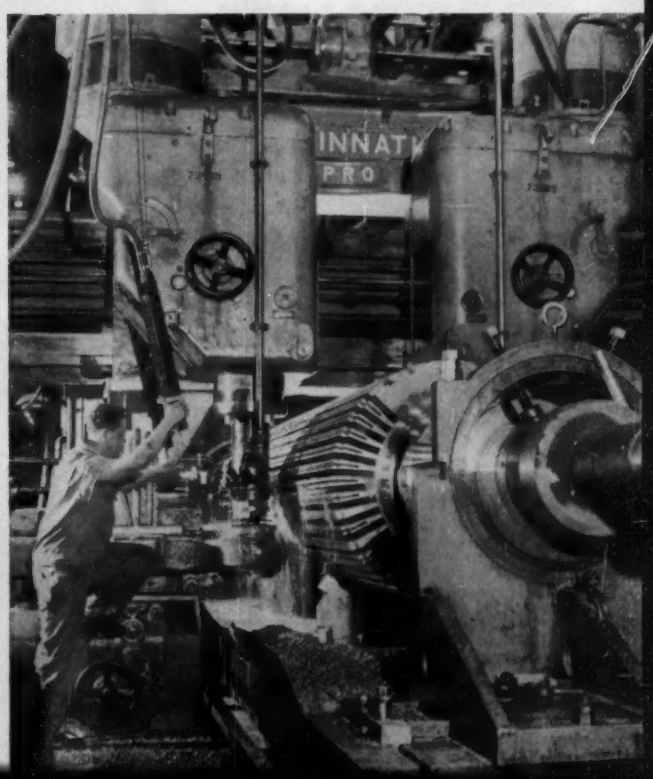
Remote control of a big horizontal boring mill is achieved by passing the pendant control box through one opening in a turbine casing while the boring head machines another



For big turning . . .

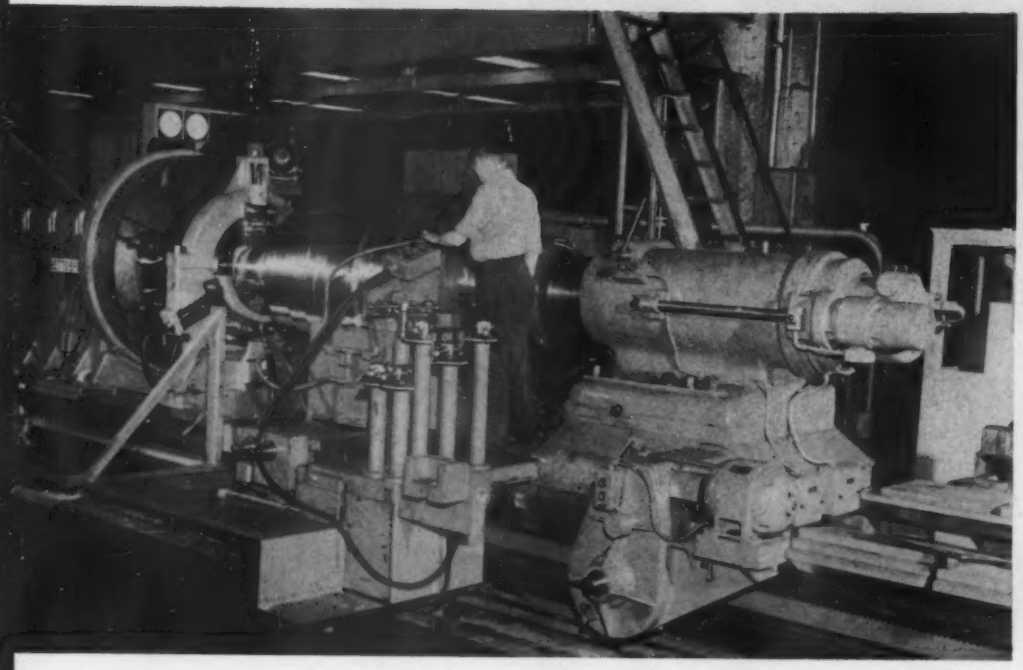
Two identical 72-in. x 40-ft Mackintosh-Hemphill heavy-duty engine lathes have recently been installed. Here a large generator rotor is being machined with the two carriages working individually. The piece is a nickel-moly-vanadium forging of 230 Bhn and weighs 100 tons. When machining is completed it will weigh 34 tons. In the closeup is one head, showing control station with independent power-feed controls. These lathes can work to close tolerances, yet can swing 86 in. (clear of carriage) by 40 ft. The tailstock has a built-in live center able to carry 120 tons, with preloaded thrust bearings and protection against overloads from work expansion during machining





Milling long slots . . .

Slots to hold rotor windings are milled on a Cincinnati Hypro. Width of each slot must be controlled within close limits to maintain balance in the rotor

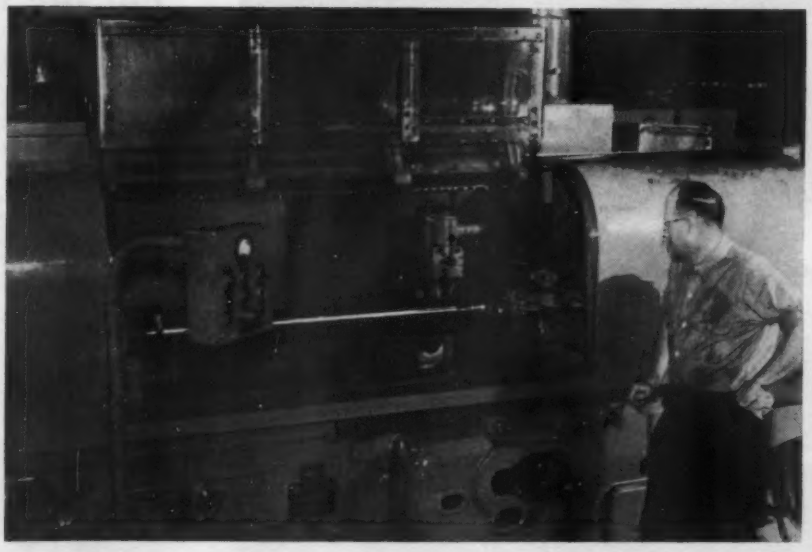


For heavy grooves . . .

A 250-hp Betts-Bridgeford grooving lathe has front and rear carriages. It cuts grooves as much as 1 ft deep to convert a solid forging into a series of integral turbine wheels. Tools are a heavy but thin bridge structure with the Carboloy bit mounted on top. Each carriage has a complete control stand plus a pendant box that is portable. Note that controls are horizontal levers on posts rather than on a vertical apron. Speed and load are indicated on dials behind the 4-ft faceplate

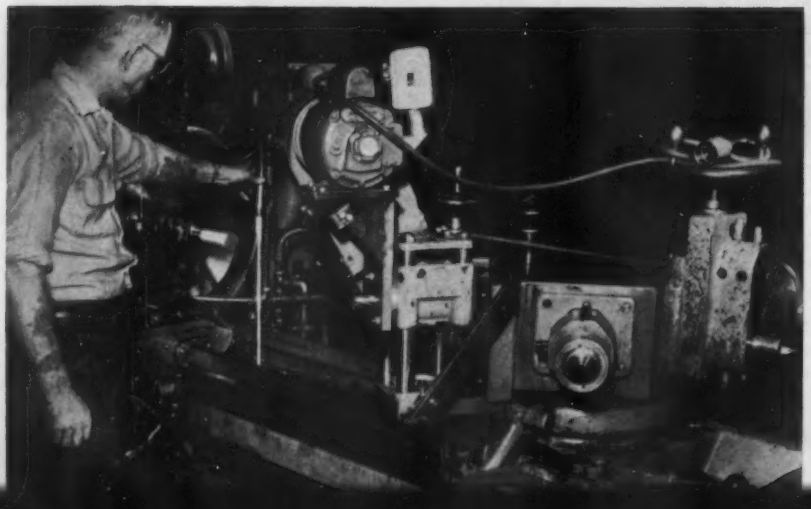
Threads plunge ground . . .

Large studs are threaded by plunge-grinding on this J & L grinder. Threads are cut in one pass at each end, for a length equal to about 1½ diameters. Wheels are diamond dressed to shape. Controls are combined in a pushbutton pendant box



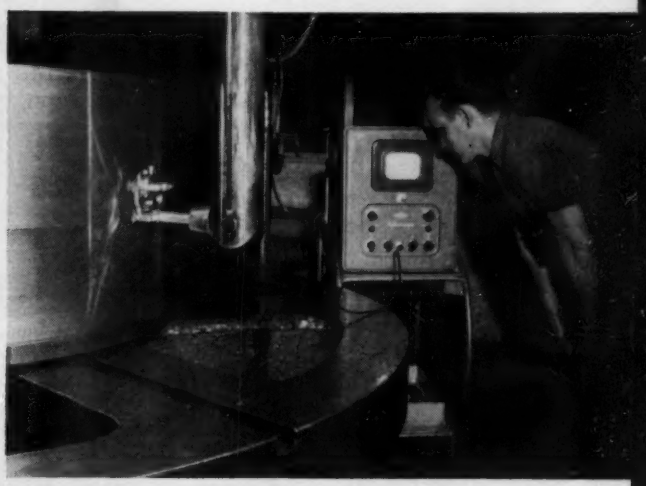
Portable miller . . .

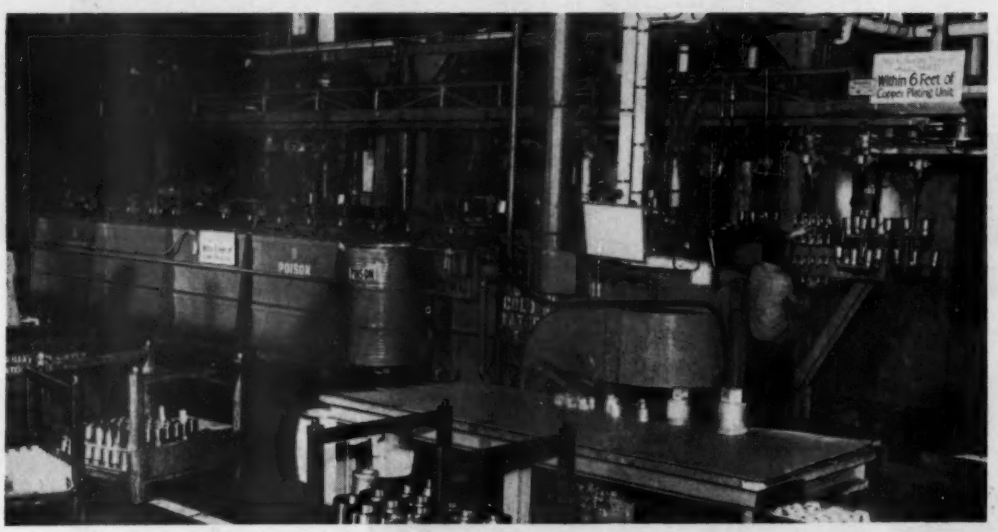
One W & S turret lathe carries a Versa-Mil unit in one turret position, with which cross slots are cut in the ends of some bolts. This saves transfer to a separate miller for this one operation



Tester on wheels . . .

Portable Sperry ultrasonic testing equipment is used on a variety of parts. Here are two typical tests — of a generator rotor while still in the lathe, and of a generator retaining ring while still in the boring mill. This type of test equipment is readily portable and can check heavy sections, so is widely used





Auto plating proves cheaper . . .

This fully automatic plating machine (Udylite) copper plates threads on large studs and nuts to inhibit galling and corrosion in service. Although operated only 32 hours a week, it paid for itself in a year

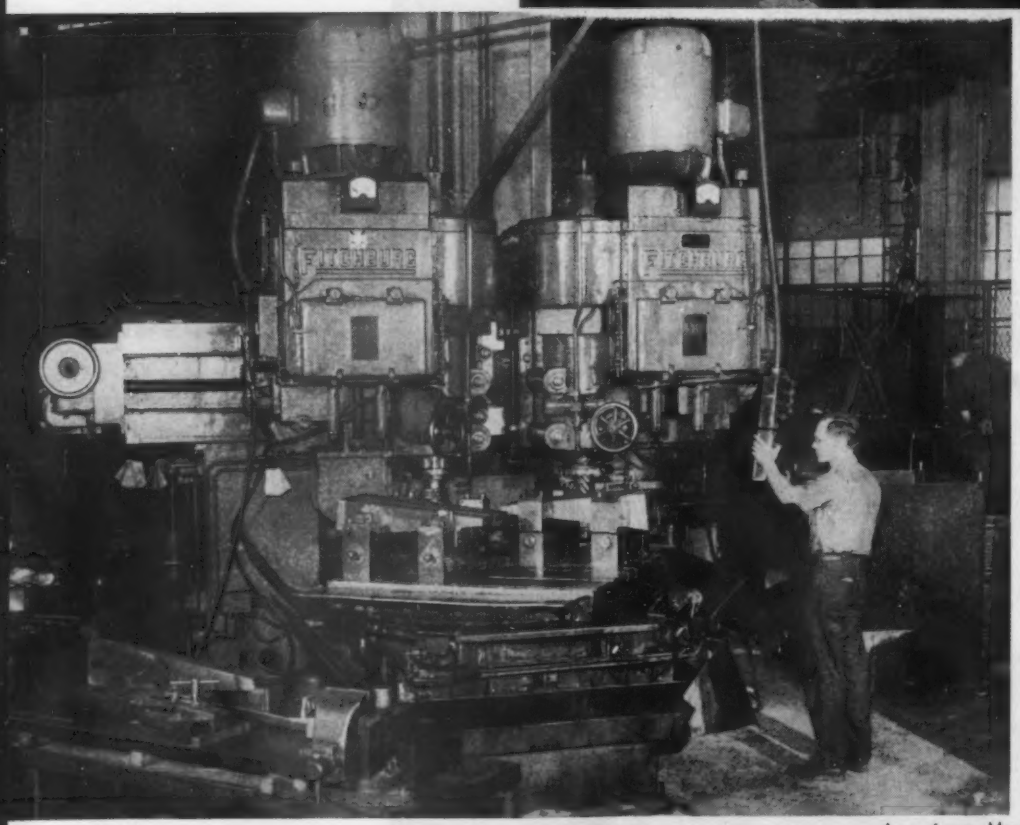
Rotor balance pit

Generator rotors are balanced at full speed. Here is the concrete pit in which they are tested. Steel-plate dividers and interlocking sectional covers provide protection to operating personnel. A turbine at the far end provides motive power. Test results are observed at the panel station in rear

Buckets are complex parts to machine

Ends milled to shape . . .

Bucket blanks, of tough stainless steel, are machined to a wedge shape, then ends are milled, one for the shroud band, the other for the dovetail. This K & T 2-spindle machine is one method of doing the job. The machine has a 2-position indexing table, so one group of blanks can be set up while another is milled

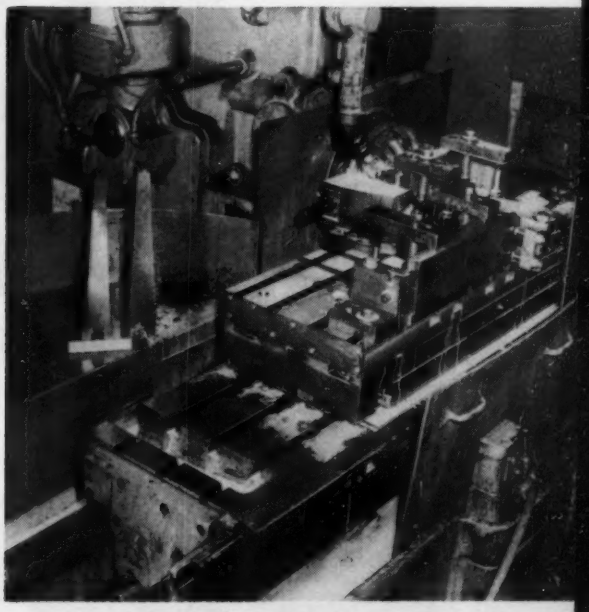


Multiple cutters . . .

This 2-head Fitchburg also mills bucket ends. Again a rotating table is used to permit setup during milling. Here one spindle has three small cutters (to produce rabbet on small end) on one spindle, while a side mill and face mill (for large end) are on the other. A checking fixture is in foreground

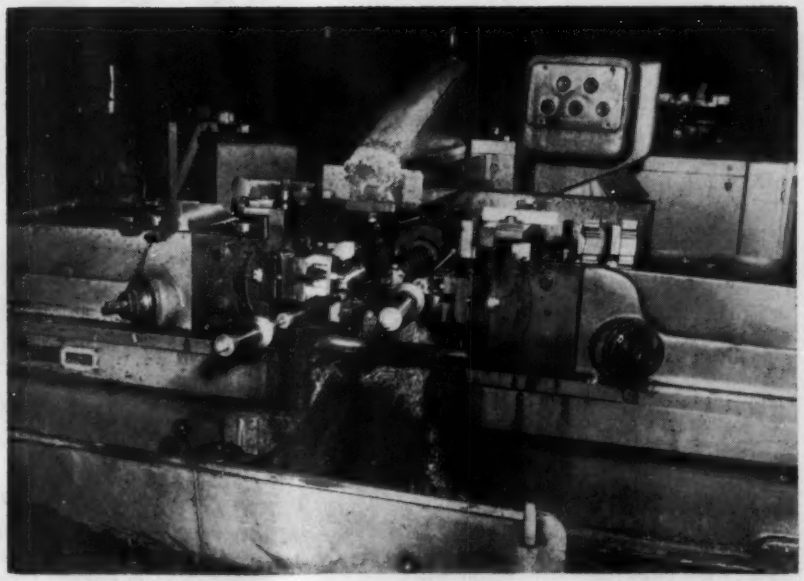
Face milling with two fixtures . . .

Sides of buckets are roughed to shape in a new Sundstrand miller. Here again two fixtures are used, on a surtable which pivots. A face-milling cutter does two blanks at once



Plunge-milled cups . . .

The cup or inside of the bucket is machined by plunge milling in a twin-table machine. Each bucket is held in its own fixture and the two are forced against opposite sides of the same slabbing cutter, completing both cups at once

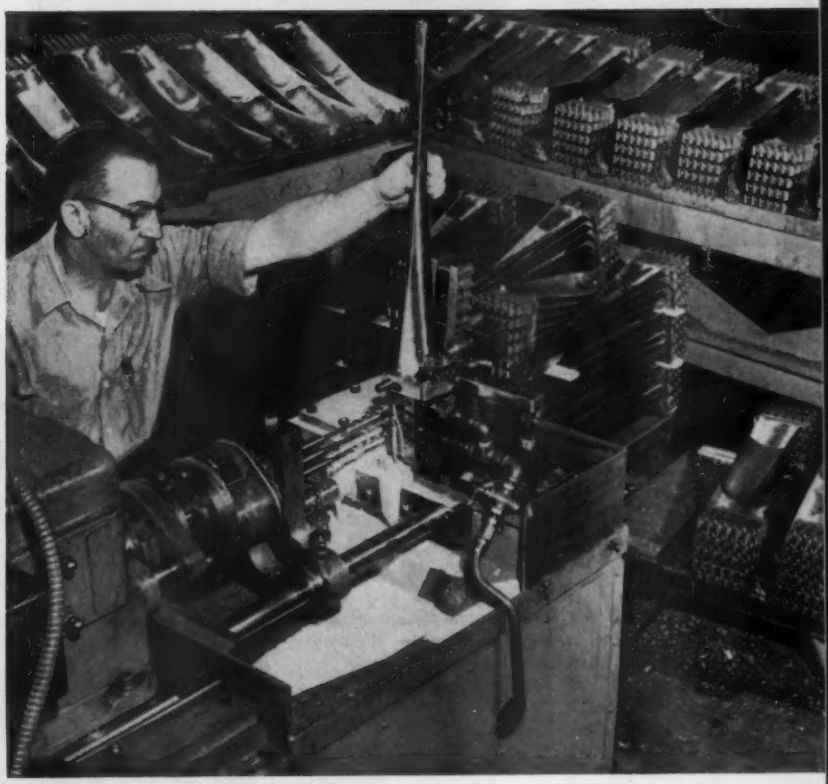


Rise and fall milling . . .

Bucket surfaces are machined in a Cincinnati with a special fixture on trunnions. Compound curves are generated by pivoting the work in the fixture at the same time as the table rises and falls under cam control

Radius-milling dovetails . . .

Dovetails on buckets must be milled to a radius to match the wheel or disk on which they will be mounted. To achieve this, the bucket is held in a fixture on a Rigidmil. This picture swings on an arm which can be set to disk radius, so the bucket follows an arc as it passes the cutter. A completed bucket is shown just below the one in the fixture



Precise bucket drilling . . .

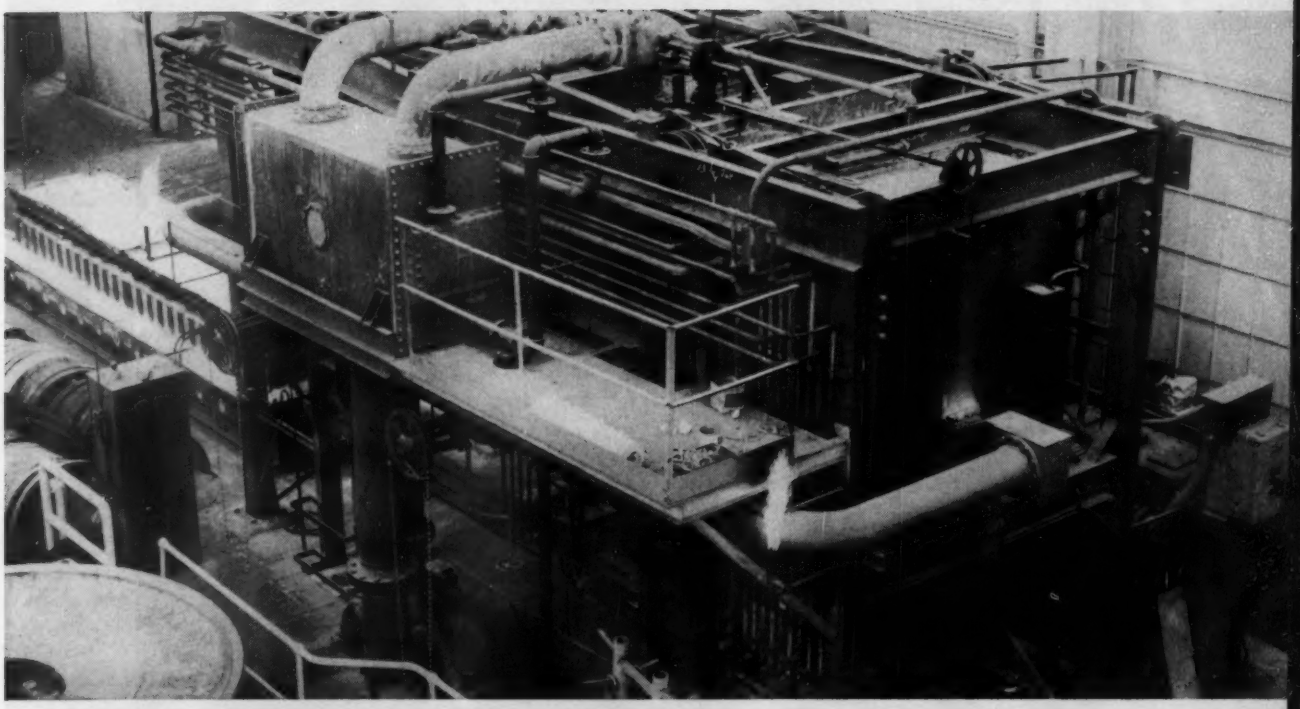
Precision boring machine has been equipped with a standard drillhead to drill three holes through the root section of turbine buckets. Note the heavy guides used to insure perfectly straight travel of the drill head

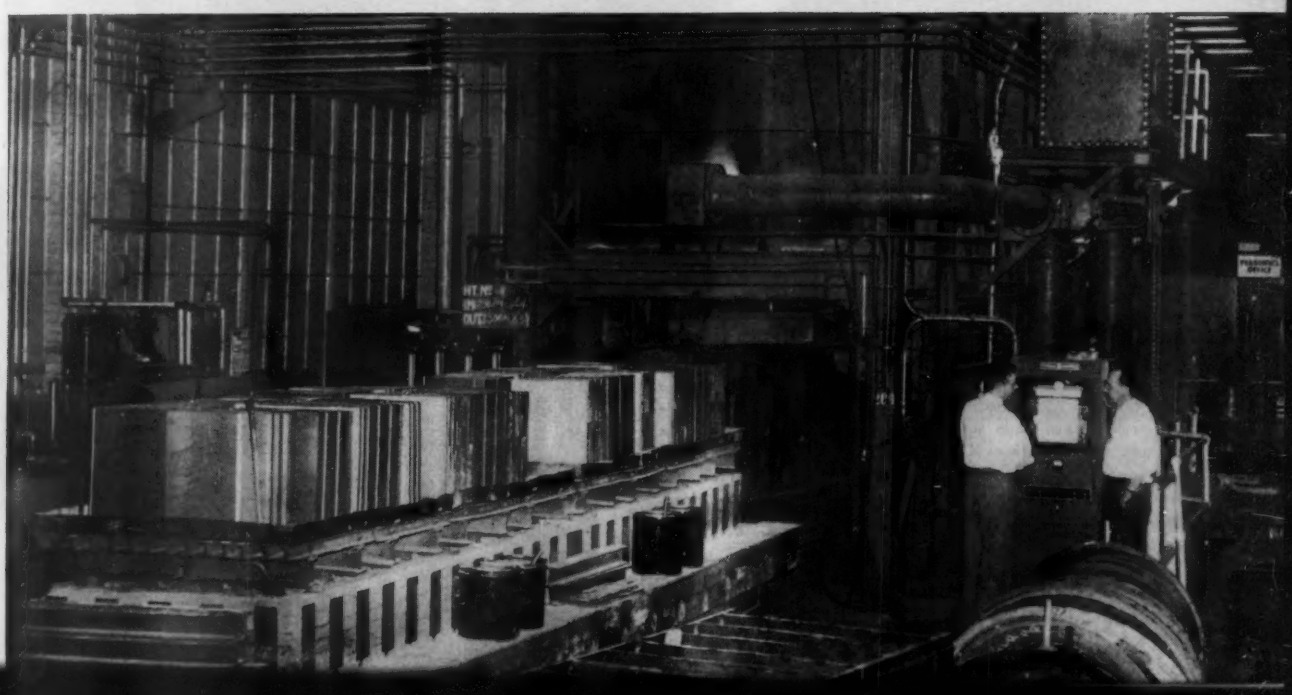
Roughing cut . . .

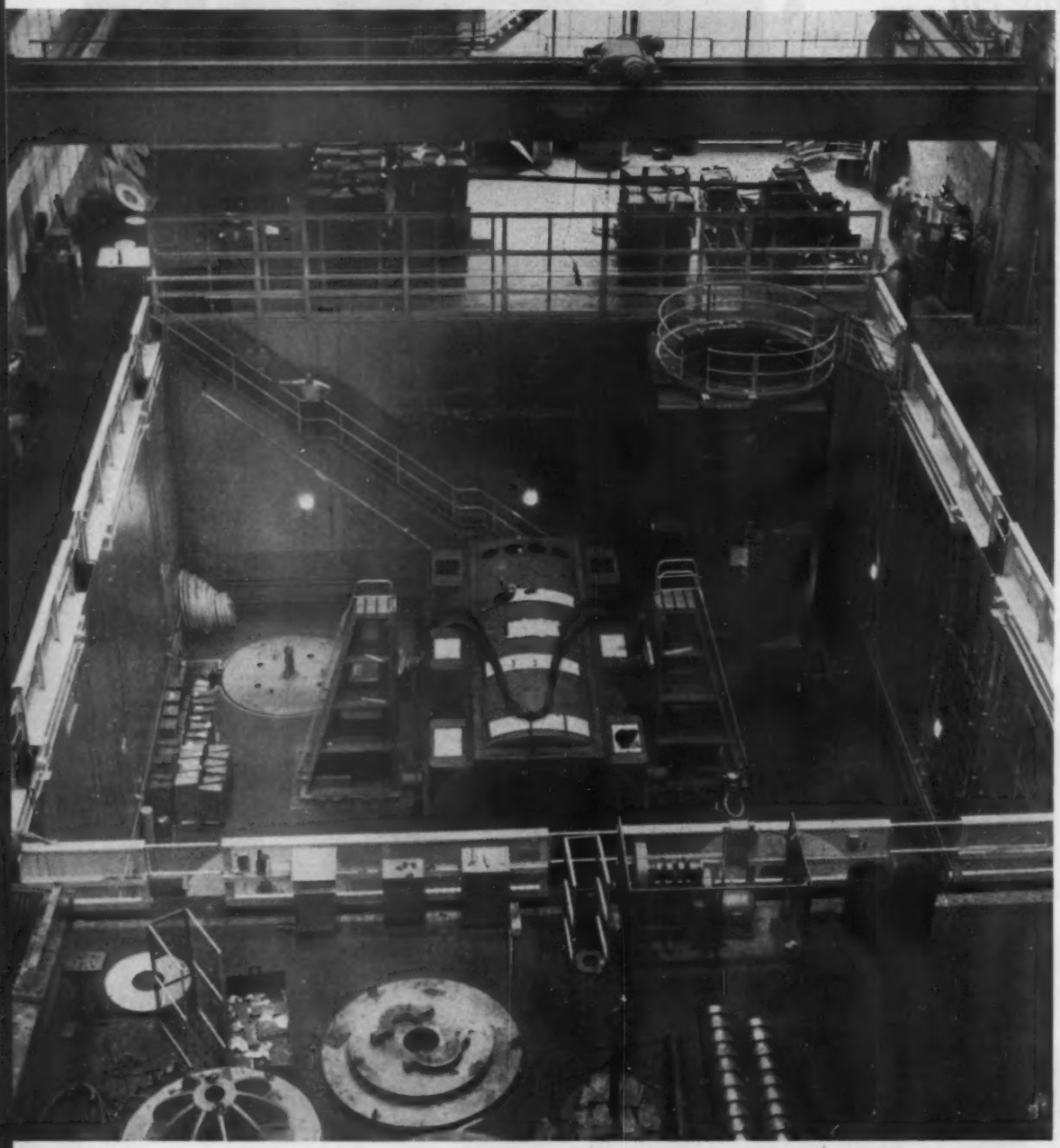
Convex surface of nozzle is machined on a tracer-controlled planer equipped with a special sub-table. Only one part is shown here, but standard practice is to machine the parts two at a time

Punching anneal...

Generator punchings are annealed in a dry hydrogen atmosphere in this special car-type furnace. Punchings are stacked on either of two cars (so one can be loaded while other is in furnace), covered with protective hoods. The whole car is then lifted into the furnace. The car becomes the furnace bottom for the annealing cycle

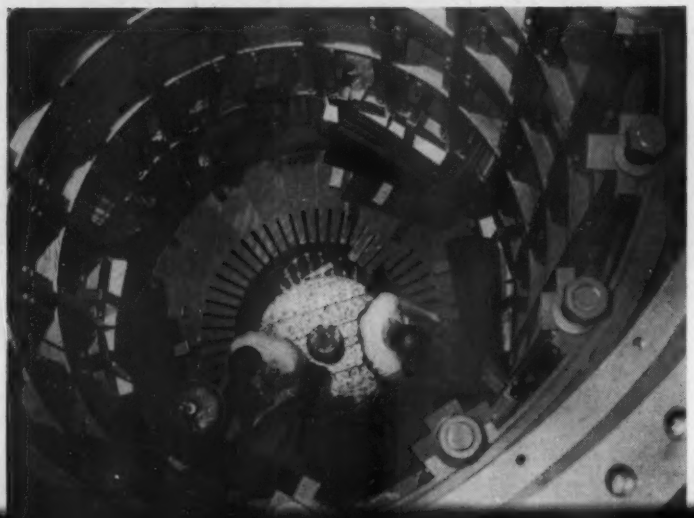


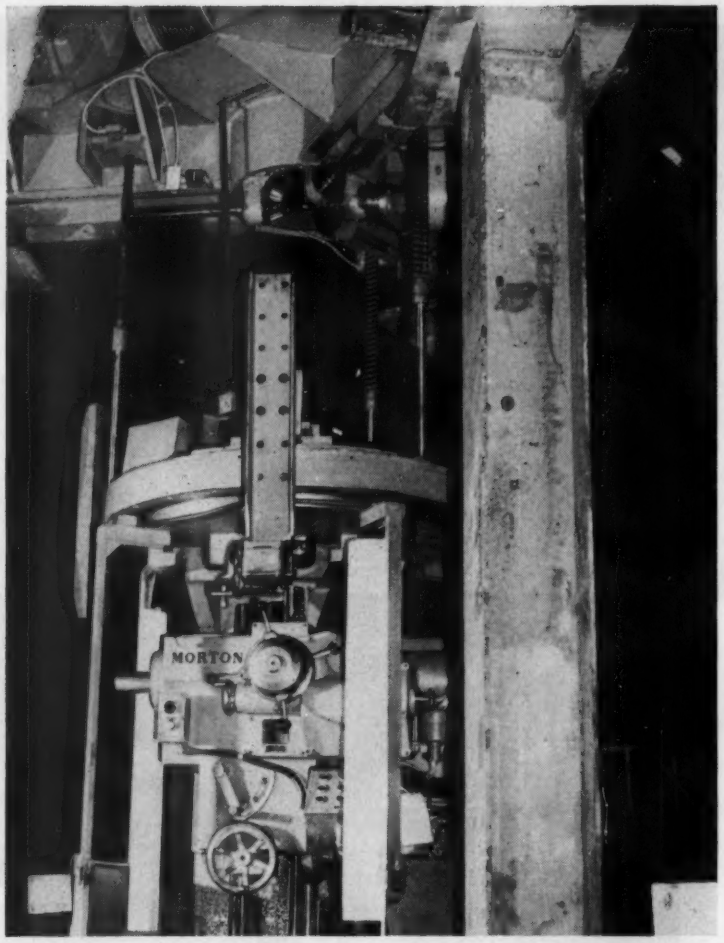




Assembly problems . . .

Stators are stood on end for lamination stacking — a job involving 200,000 to 400,000 separate punchings, all of which are stacked by hand. Periodically during stacking, pressure is applied with a hydraulic jack equipped with a coverplate (foreground) to compact the stack. This stacking job was formerly a complex and dangerous operation requiring assemblers to use bos'n chairs for traveling up and down the stator. In addition, it tied up cranes which were unable to bypass upright stators on the plant floor. Now this assembly problem has been solved by this 30-ft pit which has six stations. Each station is equipped with a hydraulic jack, which not only applies pressure to compact the stack, but also moves up through the stator center (shown in close-up) and supports a work stage at proper levels for assemblers as stacking progresses



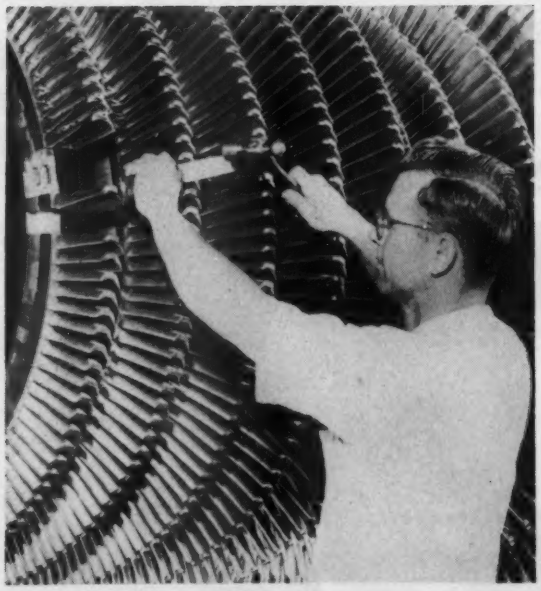


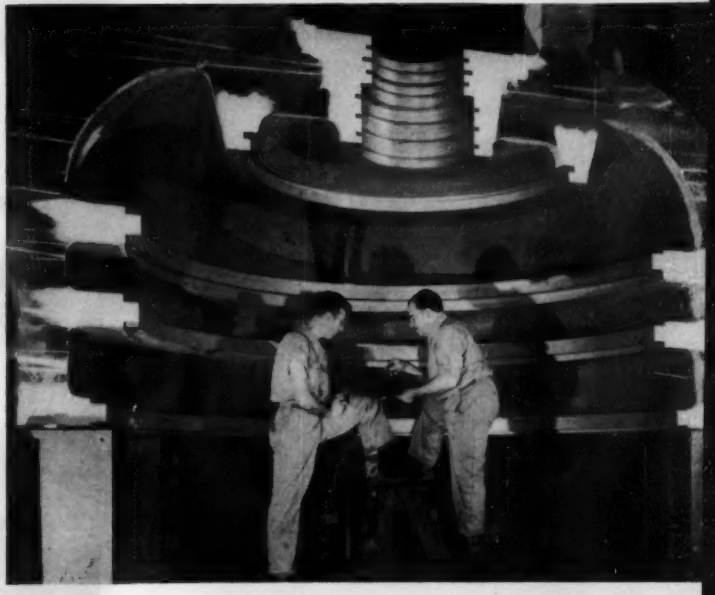
Up and down . . .

Portable electric elevator carries a horizontal drillpress. It is installed inside stator frames to permit the operator to drill and tap 600 holes which cannot be machined before assembly. One operator runs the elevator, the other operates the drillpress

Quality control . . .

Methods quality control concept makes it possible to maintain dimensional quality for ease of assembly of one-of-a-kind parts such as this turbine shell. Using process and machine capability data, tolerance limits can be set and maintained. Deviations can be corrected before limits are exceeded and work is spoiled



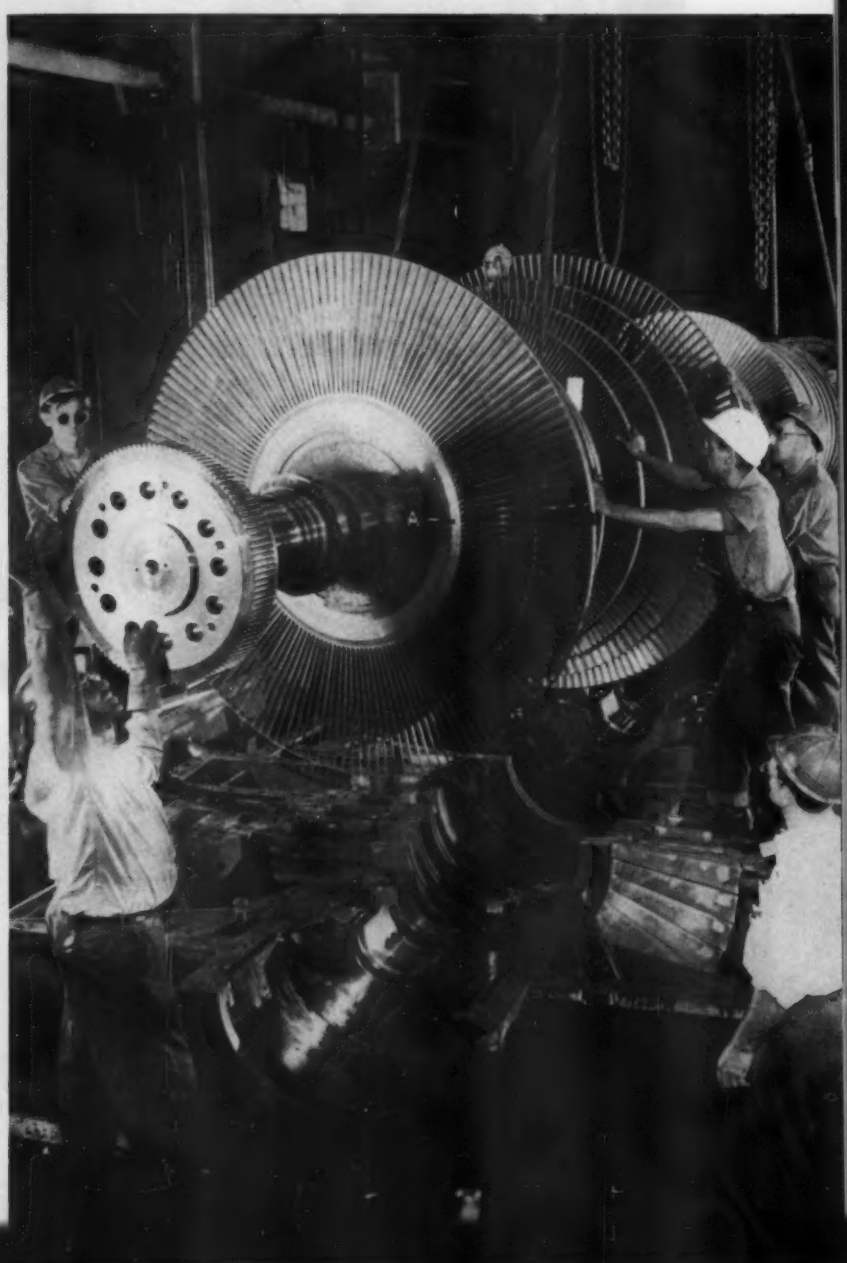


One by one . . .

There may be as many as 5000 buckets on a turbine rotor and each must be installed on the wheels by hand. The notch opening just above the bucket being mounted permits the buckets to be inserted over the dovetail on the wheels; it is closed by a special lock after the last bucket is installed

Water quench . . .

Shrink-fitting turbine wheels on a turbine shaft is a spectacular operation as streams of cooling water pour over the heated wheels. This method saves several hours over the earlier way of allowing the assembly to cool in air



Gently does it . . .

It calls for skillful handling to position the rotor assembly into the lower casing with each wheel fitting closely into its appointed slot. One little bump with this multi-ton unit can cause thousands of dollars of damage and weeks of lost time

Local cafeteria . . .

This turbine shop is so large that a single cafeteria, even at a central location, might involve a quarter-mile walk each way. To provide cafeteria service in several areas, food-dispensing counters like this have been set up in various locations. Sandwiches, coffee, tea, ice cream, pie, and the like are available, in disposable containers so there is no "return" problem

Maintenance on wheels . . .

Tools for machine repair are carried to the job in wheeled carts, eliminating repeated trips to the tool crib. Bonus is provided by building carts so tops can serve as workbenches

LARGE STEAM TURBINE-GENERATOR DEPARTMENT
GENERAL ELECTRIC COMPANY
COLOR CODE for GRINDERS and GRINDING WHEELS

	R.P.M.	MAXIMUM WHEEL DIA. RESINOID 9500 S.F.M.	MAXIMUM WHEEL DIA. VITRIFIED 6500 S.F.M.
BLUE →	3000	7" DIA.	5" DIA.
GREEN →	6000	6" DIA.	4" DIA.
RED →	9000	4" DIA.	2¾" DIA.
YELLOW →	12000	3" DIA.	2¼" DIA.
PURPLE →	18000	2" DIA.	MOUNTED POINTS *
WHITE →	21000	1¾" DIA.	MOUNTED POINTS *
PINK →	40000	MOUNTED POINTS *	MOUNTED POINTS *

*MOUNTED POINTS—THE SIZE, SHAPE, SPINDLE DIMENSIONS, AND OVERHANG MUST BE CONSIDERED WHEN DETERMINING THE SAFE OPERATING SPEED OF MOUNTED POINTS.
CONSULT THE ASA SAFETY CODE #B7-1943 FOR ALL APPLICATIONS OF MOUNTED POINTS.

GRINDING WHEELS—WHEEL SIZES INDICATE THE LARGEST DIAMETER GRINDING WHEEL THAT MAY BE USED WITH SAFETY. THE COLOR OF THE WHEEL AND GRINDER MUST CORRESPOND.

CAUTION—IF THE GRINDING WHEEL IS NOT THE SAME COLOR AS THE GRINDER DO NOT USE IT.

TG-1390-A (12-53)

Pocket color code . . .

for operators is key to matching color code painted on hand grinders and grinding wheels. All wheels are grouped according to recommended maximum speed and painted the same color as the grinder on which they can be safely used. Large posters in the plant cover the same information and serve as a constant reminder

For a close look . . .
at how maintenance is handled in this huge and complex plant turn the page . . .

BETTER APPROACH TO MAINTENANCE

Maintenance services see that production men are supplied with machines in good condition, sharp tools, necessary tooling, material, power, and all other services for maximum output. This approach to maintenance has helped to make it possible to increase plant output greatly

To keep all the equipment previously pictured operating is a tremendous maintenance problem, involving an extensive organization. The word "maintenance" covers an unusually large variety of operations. Basically it includes everything necessary to keep the plant going.

Present five-branched organization of the Maintenance sub-section was established three years ago and is one of the major reasons for the plant's excellent operating record. It is basically designed to apply the principles of preventive maintenance. Operations are all programmed to keep the crews busy. Men are shifted from scheduled maintenance when emergencies arise, but careful, regular scheduling reduces the number of emergencies to be met. For example, where three years ago an average of six inert-gas arc welding machines were out of service for repair, regular maintenance now makes breakdowns a rarity.

The five branches, each under a general foreman reporting to the superintendent of factory maintenance, are:

1 .. Machine repair
2 .. Non-durable tools and shop supplies
3 .. Materials handling
4 .. Shop maintenance
5 .. Toolroom

Machine repair

Maintenance of machines starts when they are being initially erected on the floor. One man from the repair section works with the erection crew and learns assembly and operation of the new machine, and in turn trains other repairmen.

Drawings of the machine are studied, wear parts are located, and spares immediately stocked along with assemblies likely to need unit replacement.

Certain regularly scheduled inspection and maintenance operations are provided; for example, a repair crew washes down and re-oils the columns of all radial drills once a month. The radials are inspected for any possible damage and at the same time any scratches on mating parts are polished off to prevent scoring.

One repairman is assigned to the grinding room to watch the machines and inspect them in rotation. Another inspects screw machines, a third handles inert-gas arc welders. Normally, one repairman is also assigned the task of checking and eliminating end play in milling machine spindles.

Special balling mills for ball-seat bearings pose a special problem because of the critical nature of the operation. These must be checked several times a week to insure continued accuracy.

REPAIR RECORDS

Repair crews operate under two foremen, each responsible for half of the building. As repairs are needed, a shop order is made out and jobs are scheduled. The foremen of each first-shift crew establishes priority of jobs for 2nd and 3rd shifts as well as his own. When necessary to meet an emergency demand, men are borrowed from the other crew or shifted from regular maintenance jobs such as those previously mentioned.

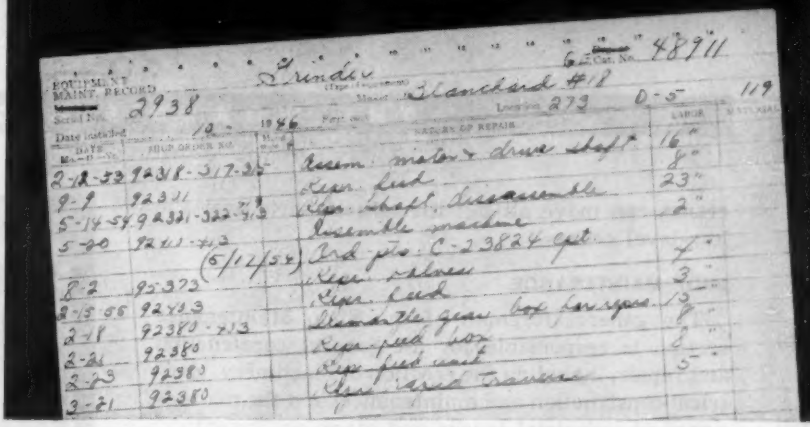
An equipment maintenance record — one card for each machine — is kept, on which every repair job for that machine is posted. Thus for each machine there is a record of maintenance cost, and those machines that become too expensive to maintain are soon picked out for replacement. (Machines can also become obsolete because of the availability of a more efficient machine, but checking on this is a different problem . . . not a function of Maintenance.)

Any machine down for repair for more than one shift, including any pulled out of production for rebuilding, is posted on a board in the superintendent's office for easier watch on special problems.

When it is necessary to use a machine beyond its normal capacity, the setup must be cleared with Machine Repair. For example, a large part to be handled on the largest available boring, drilling, and milling machine required a travel 26 in. beyond the limits of the column saddle. After careful inspection, the Machine Repair Section concluded that the column could be run 8 in. off the ways at one end and 18 in. off at the other without either damage to the machine or failure to hold tolerances for the part. This was done, and the part was machined successfully.

CUTTER GRINDING

Tools, such as carbides, chipbreakers, and special cutters, are generally sharpened by the Machine Repair Section in a central grinding room. Of general interest, it might be pointed out that single-point carbide tools are ground with green-grit silicon carbide wheels. Roughing is done with a 60-grit wheel (DC60-K7V or GC60-K5VR) and finishing is done with a 120-grit wheel (GC120-H8VBR). In both cases, mist coolant is applied using Vantrol No. 50.23, 100 to 1, largely as a rust inhibitor.


Grinder — Standard #18 — Cat. No. 48911
EQUIPMENT MAINT. RECORD — Serial No. 2938 — Location 272 — D-5 — 119
Date installed 12- 1946
DATE | SHOP ORDER NO. | NATURE OF REPAIR | LABOR
2-22-52 92438-317-2 — Recon. motor & drive shaft — 16"
9-9 92311 — Repl. belt — 8"
5-14-54 92321-322-713 — Repl. shaft, disassemble — 23"
5-20 92311-713 — Assemble machine — 2"
(5/14/54) — Ord. pts. C-23824 opt. —
8-2 92373 — Repl. valves — 4"
8-13-55 92413 — Repl. belt — 3"
2-28 92380-713 — Dismantle gear box for repair — 13"
2-21 92380 — Repl. pad box — 8"
2-23 92380 — Repl. pad unit — 2"
3-21 92380 — Adj. spiral traverse — 5"

EACH REPAIR JOB is posted on the equipment maintenance record for machine involved. This record indicates maintenance costs and pinpoints machines in need of replacement

An exception to central grinding is on special cutters for planers that are ground at the machine.

Non-Durable Tools and Supplies

This section, which stocks some 7,000 different items, began to organize its present system in 1952. Since that time the total cost of supplying non-durable tools and shop supplies has been cut by more than one-third.

In order to hold tool costs down, tests were made on various tool steels to determine the types and brands that would best suit requirements.

In similar fashion, tests have been devised for purchased items. Mounted grinding points, for example, were found to vary from lot to lot; so a special device, consisting of a portable drill and a weighted steel bar, was built for checking them. The point is rotated against the bar until it disintegrates. The bar is then weighed to determine the weight of steel removed. Information from these tests is tabulated and compared with tests on a batch of previously accepted points of the same size. When a batch of new points fails to stand up under this comparison, it is rejected.

This incoming test has been so successful that it has been extended to snagging wheels, and a surface grinder is now being equipped to make similar tests on other wheels.

TOOL DESIGN CHANGES

A wedge-slot milling cutter has been redesigned from four teeth to six with an adapter to cut the arbor size required.

Up to 5¾-in. dia, shell taps have been adopted to fit a standard arbor. Six arbors handle 11 tap sizes and the cost of large taps has been reduced from about $300 to $80.

Designing drill extensions with a drive-key slot instead of a tang has eliminated the loss caused by twisting off driving tangs.

Such studies of every tool used are being made with a view to saving on initial cost, getting better or more consistent performance, and reducing the chance of accident or breakage.

On one operation, for example, half-round files are required. Only the front end of these files is used. By ordering the files cut only on the front 3 in., a file was obtained that was easier to use, had just as much life, and saved $1.18 per dozen. These files are needed at a rate of 200 dozen per month.

TOOL CRIBS

There are six tool cribs in the plant, plus a central tool storeroom. After experimenting with the brass check on one crib, it has been decided to use a paper-check system with a limit on the number of charges each man can have at one time.

All pin gages are checked once a week and marked with a color code which indicates when they must be rechecked before further use.

As would be expected, tools and gaging surfaces are protected with a strippable plastic when in the tool crib. A feature is that when tools are returned to the crib in good condition, except that sharpening is required, they are immediately dipped in strippable plastic to protect them until ground.

MATERIALS HANDLING

The large steam turbine-generator plant has 54 overhead traveling cranes ranging in capacity from 2 to 200 tons. In addition, the high-level cranes in the main bay can handle 240 tons, or by working in tandem, over 300 tons.

One bad crane move could ruin months, perhaps years, of work and cause serious injury to workmen. Therefore all movements are carefully scheduled and synchronized by crane foremen.

In addition, all crane personnel are specially trained in a school conducted by the Materials Handling section. The main tool in this school is an operating model crane which lifts scale models of turbine and generator parts, giving crane operators and followers a chance to observe and practice the lifts they will encounter on the job.

The model crane is also used to plot complicated moves or turnovers. Scale-model parts are made, and moves that will be required with the actual part are worked out, using the model crane. The addition of lugs or the shifting of lugs already planned may make a substantial difference in reliable handling. This can be discovered by trying out the move in advance with models.

Once a year, all crane hooks are X-rayed and any that show signs of incipient cracks are replaced. All crane cables are inspected once a week and replaced at any sign of damage. When a job with rough edges is being handled, crane followers and foremen are continually checking for possible damage or faulty hookup.

Scheduling of crane carries is simplified by having cranes operating on two levels. The high-level

cranes can move all but the largest parts over the low-level cranes.

SHOP MAINTENANCE

The general foreman of the Shop Maintenance section is responsible for all general construction and repair, including the erection of machinery, electrical construction and maintenance, and the maintenance of industrial trucks and other equipment.

Most machines are repainted about every six months. Experiment has shown that for about three months after repainting, the machines look fine and operators are especially careful. After this period, a gradual decline in appearance and care sets in. Six months appears to represent the optimum compromise between the cost of constantly keeping machines looking their best and the carelessness that can result from not maintaining appearance at all.

TOOLROOM

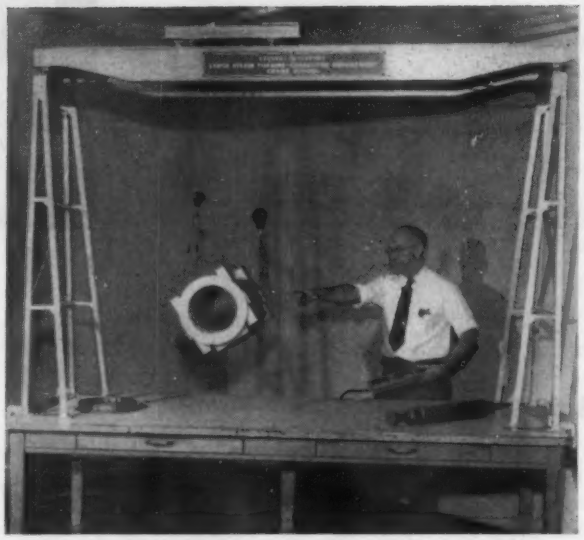
The Toolroom manufactures special tools, jigs, and fixtures for the turbine plant, and also does developmental work for the engineering staff. To supplement its own standard equipment, the Toolroom can make use of the large machines in the plant when necessary, and (because most machines are general-purpose types) this makes almost any machining operation, big or little, possible.

In some cases, the Toolroom builds or adapts special machines. For example, some boring operations on large stators are performed with the stator standing on end on the plant floor. Inside, a column mounted on a rotating table carries the tools. This "machine" is completely encased by the work and one of the prinicipal problems is getting the operator in and out. (For a more complex machine to perform similar operations in this plant, see *AM*, May 28 '51, p 111.)

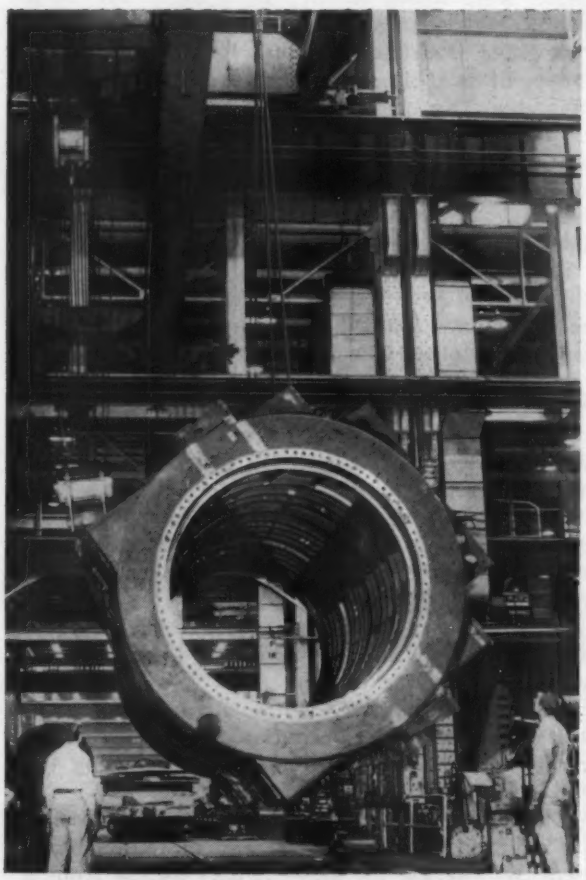
Examples of special fixtures, such as the turnover fixture for milling slots in the generator rotor, are shown in several of the illustrations of unusual operations herewith.

Afterword

Our effort here has been to indicate ideas and methods, not to provide details. In an operation of this magnitude, it is impossible to tell everything. What we have done is to select those elements that delineate highly successful and broadly applicable procedures. There are hundreds of others, obviously, that contribute to this plant's outstanding operating record. Such efficiency has been attained that a plant designed for highly efficient production in the first place has been able, by sound operating principles, almost to triple its initially planned output. This indicates there are several principles, ideas, and methods here that you can use effectively.—The Editors.



ELECTRICALLY OPERATED MODEL CRANE serves not only to give special training in handling turbine and generator parts to all crane personnel, but also for tests on models of new parts to make sure they can be handled safely



CRANES AT TWO LEVELS work together to turn over a stator. Such operations are planned carefully to avoid accident that might cause injury or damage to part or plant

Round Table

Off Again, On Again

"What happened to Johnson, Ed? I though he'd left long ago."

"He was going to, Al, but he changed his mind. If I had my way we'd fire him, but Personnel says we have to keep him on if he wants to work."

"Well, I should think you'd be happy to keep a good man, Ed. What's bothering you?"

"Why, we had all the red tape done with, and a couple of transfers and a promotion all lined up. Then Johnson changed his socalled mind, and decided to stay."

"You can't fire a man for changing his mind, Ed."

"I'd sure like to! We had all the records arranged, and everybody involved was all set for the change, then it fell through. I know the men who were going to be shifted are pretty mad about it. After all, they'd probably been looking forward to a change."

"That's too bad, Ed. I can see that it would upset things a lot. Did Johnson know what he was doing, or was he drunk all the time this was going on?"

"I don't know, Al. He said he was leaving, then he went and talked to Personnel, and they started the paper work. Next thing I heard from Personnel was that Johnson had changed his mind, and everything was cancelled. Then the gripes started to come in."

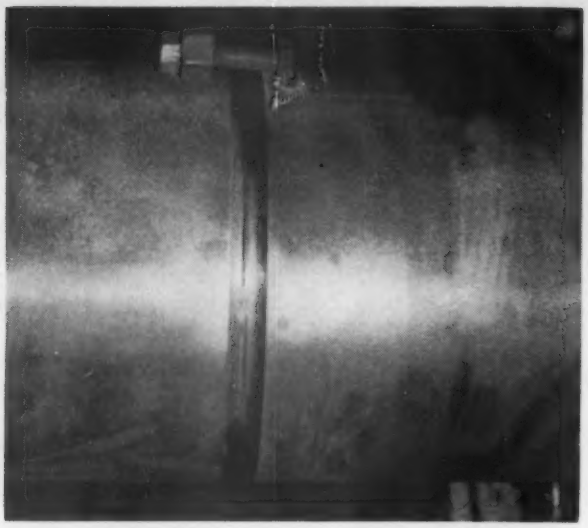
"Oh, that'll quiet down after a while."

"Sure; but in the meantime, the company's spent I don't know how much money, time, and trouble in trying to get Johnson straightened out. I'd like to demote him or something. Teach him a lesson!"

"That sort of thing doesn't happen very often, Ed. I think you're getting too steamed up about it."

"Yeah? Why don't you try promising new jobs to half a dozen men, then break it to them that the deal's off? It sure doesn't help labor-management relations a bit."

***Should Johnson** be criticized — or punished in any way — for changing his mind? What can Ed do for the men who were going to move up, then were disappointed? Your ideas may help others with a similar problem. Discussions of earlier topics start on page 224.*



WELDING GROOVE must be wide enough to permit the welder to manipulate the rather heavy volume of slag. Careful cleaning is necesary to prevent oxidation caused by scale or rust. Temporary joiners hold the sections in place

WELDER MUST HOLD his arc as short as possible and maintain an angle as near 90° to the work as he can. A longer arc, or excesive tilting of the electrode, would introduce air to the arc zone, with resultant oxidation

New system welds chrome-moly

High-quality, corrosion-resistant welds are produced with a special electrode and a somewhat different welding technique

Welding chrome-moly steel for use in high-temperature, high-pressure service presents considerable difficulty because the material tends to harden and become brittle after air cooling from welding temperature. The problem has been the subject of extensive research by one of the leading manufacturers of power boilers and pressure piping, and out of this has come a new type of low-hydrogen electrode with closely controlled carbon content and a straight lime coating. This has now been classified under AWS and ASTM specifications as Type XX15, but the electrode alone is not the whole answer to the problem—a special welding technique is also involved.

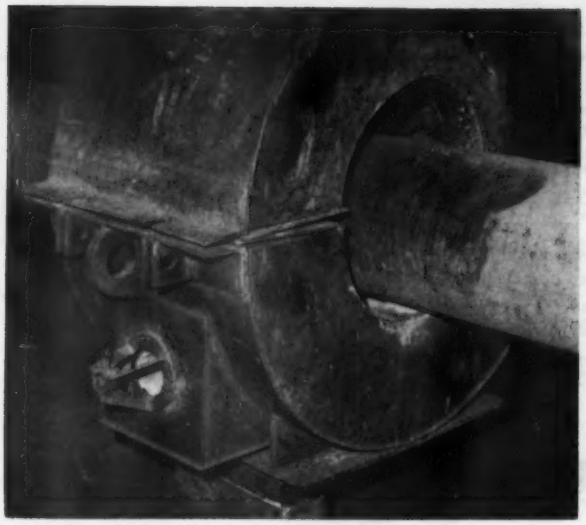
The originators of the system have had it in use for several years and have now authorized Metal & Thermit Corp to merchandize the system under the name of Murex Croloy System. It can be used with conventional reverse-polarity dc equipment for all-position welding, and will provide a weld deposit of controlled analysis and high ductility.

TECHNIQUE

Prepare the welding groove and fit the joint carefully because of the heavy volume of slag produced. Root opening must be wide enough to manipulate the slag and insure good penetration. If there is no root opening, make the included angle not less than 90°, if the root opening is ⅛ in. or more, included angle may be 60° or less. Clean the weld area to remove all scale, oil, or rust because accidental inclusion of any source of oxygen will seriously affect the quality of the deposit.

Preheat to 100 to 200 F lower than normal. For steels with lower chromium content, 300 F is hot enough (rather than the usual 500 F), except on extremely heavy sections. For 2¼ chrome—1 moly, and 5 chrome—½ moly, apply preheat more carefully, even though there is considerably more latitude than when using high-carbon electrodes. Preheat requirements for a given job depend on geometry and thickness of the weldment, but the heat-affected zone will harden to the same degree, regardless of the ductility of the deposit, so some preheat is always necessary.

Maintain a close arc to avoid introduction of air, with resultant difficulties from oxidation of the weld puddle. A short arc is essential for maximum weld quality. Keep the electrode at 90° to the work because excessive tilting will permit the introduction of air into the weld zone. This may appear difficult on pipe work but it can be accomplished with a little practice. Use a weaving technique to retard cooling of the weld puddle. To avoid entrapment of slag,



STRESS-RELIEVING for welds on larger sections, or on steels with higher chromium content, may be performed with a portable gas-fired furnace. Furnace is shown in position, ready for connecting the gas line and firing up

steel

LLOYD C NESBITT, field engineer,
METAL & THERMIT CORP

limit the weave so the arc is not directed into the solidified slag. Weave can be as wide as can be managed while keeping the slag molten across the crater area. Clean slag carefully from each bead before depositing the next bead.

Steels in the lower chromium range, unless of extremely heavy section, do not need maintenance of preheat after welding and prior to stress relieving. In fact, unless applicable codes require it, many weldments can be safely placed in service without stress relieving, when welded under this system.

Steels containing 2¼ chromium and up should always receive a post-weld heat treatment. Standard practice indicates a temperature of 1300 to 1400 F for this purpose.

Keep electrodes perfectly dry, and protect them against moisture in storage as well as in use. Electrodes are shipped in moisture-proof cans and are adequately protected as long as the can is unopened. Once the can has been opened, store unused electrodes somewhat above room temperature.

Welds made by this system on chrome-moly steel will be consistently sound. The heavy coating and low moisture level of the electrodes keep spatter unusually low, and the stable arc insures a bead with fine ripples, free from porosity, and suitable for work of X-ray quality.

People keep forgetting that...

Although a supervisor decides whether or not production is increased, it is mainly up to the workers to determine the rate of production. Management in looking for answers to many problems, has found that production is improved and increased only when supervisors study and apply Human Relations. Boiled down to its basic meaning, Human Relations is simply applied common sense plus good will.

When a supervisor applies this skill, he can cut down costly labor turnover, and he can settle grievances quickly, and to everyone's satisfaction. His ability to handle workers then becomes more useful and valuable than his knowledge or technical skill. Unfortunately, many supervisors are too late finding out this very important fact.

The supervisor must realize that he spends the best part of his waking hours with his workers, so he must learn to live with them peacefully and profitably. Webster's definition of relations is the state of being reciprocally or mutually interested in the same project. If the supervisor is lax in the art of getting along with others, he will not have the reciprocal or mutual interest of his workers.

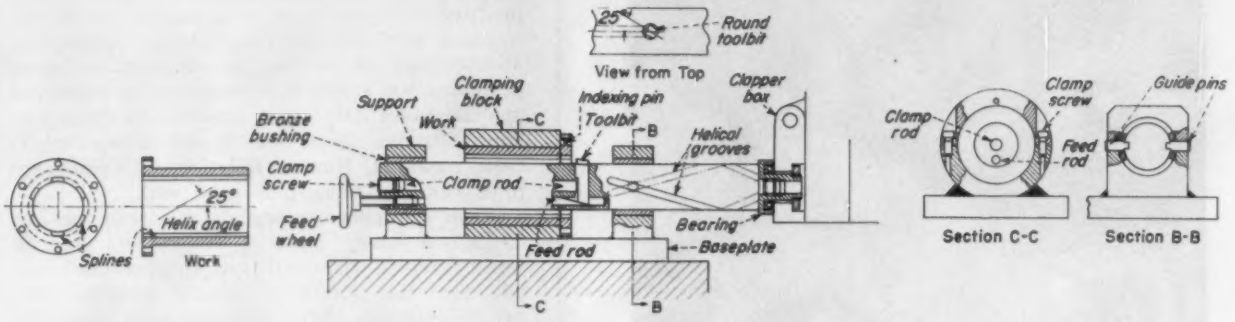
The need of studying and practicing Human Relations is well expressed by Clarence Francis, of General Foods, who, like many other executives, realizes the importance of this skill: "You can buy a man's time; his physical presence; even a measured number of skilled muscular movements per hour or day. But you cannot buy enthusiasm; initiative; loyalty; devotion of hearts, minds, and souls. You have to earn these things."

And so, in order to get the best and the most from your workers, with the least possible friction, you, as a supervisor, must learn to study and practice Human Relations. You must also understand that this study is a continuing—perhaps endless—process, but it will be worth every minute you spend on it.

G McArdle

"In this cabinet is what you might call the brains of the system."

Practical Ideas . . .



Helical Broaching Fixture Works on Shaper Table

When we had to make internal helical splines in a few bronze bushings with a 4-in. ID, we found that a regular broaching fixture and tool would be too expensive. Therefore, we made this fixture that mounts on the shaper table and is operated by the shaper ram.

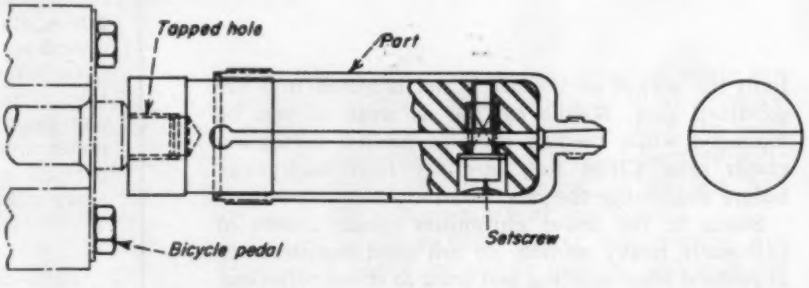
A baseplate has two supports with bronze bushings that position the boring bar. The work is held in a split clamping block, and surrounds the boring bar. It is indexed for the six groove cuts by shifting it so a pin through the clamping block picks up six holes through its flange.

The toolbit is a round cutter, held in a vertical hole in the boring bar, and prevented from rotating by a clamp rod tightened by a clamp screw at the front end of the boring bar. At the same end of the bar a feed wheel is operated to move the feed rod backward. This has an inclined-plane end, which acts on the slanted end of the toolbit, making it rise to take a deeper cut. After each shaper stroke, the wheel is moved to advance the cutter slightly.

Helical grooves are cut in the back end of the boring bar, close to the end that is attached to the clapper box of the shaper. These are picked up by two guide pins in holes precision bored through the walls of the rear bar support and the bronze bushing. As the shaper ram moves forward, the bar is free to rotate on the bearing, and the guide pins work in the helical grooves to turn it. This makes the tool describe a helical path, producing the grooves in the work.

After a groove is fully cut, the machine is stopped, the feed wheel and feed rod backed up, the cutter dropped to starting position, and the work indexed 60°. The process is repeated until all grooves are complete.

When new workpieces are to be loaded, the cutter is removed, and the boring bar pulled out of its special fitting in the clapper box. The regular toolpost for the shaper is not used. *A Vetsch, Seuzach, Switzerland*



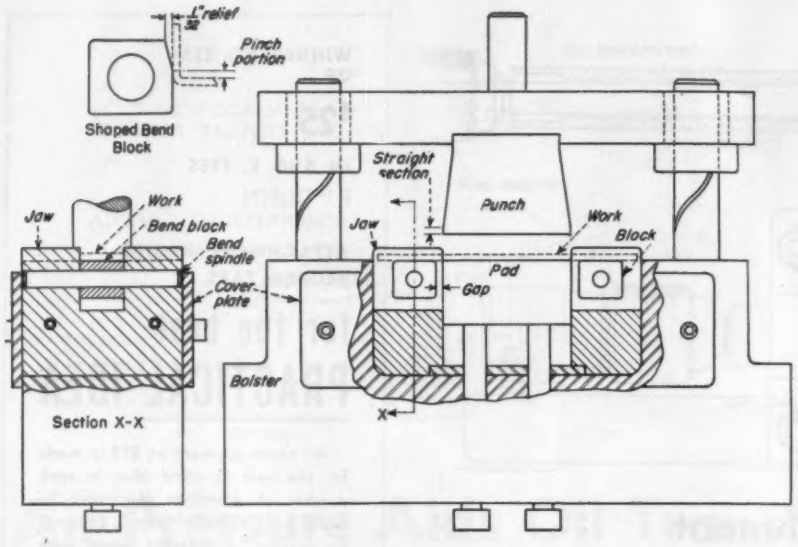
Bicycle-Pedal Fixture For Tube Polishing

The recent article by Mr H Dahl (*AM*—Aug 1, '55, p123) for polishing tubes brought to mind this one we use, which is similar but less expensive to make.

It requires a common, garden-variety bicycle pedal which threads into an arbor made to fit the part being polished. The arbor has to be drilled and tapped at the end for the pedal, and is split down the middle and fitted with a setscrew. This allows opening it so the work can be forced on to stay during the polishing operation. *O T Edlund, Detroit, Mich*

Compound Aids Layout

Salvage the compound of a scrapped lathe, and mount it on the drillpress table. The dial feeds give a quick, handy way to make rough layouts on one piece. *Gus Wernberg, Geneva, NY*



Bending Die Set Wears Better With Rolling Bend Blocks

Better action when stock varies in thickness is one advantage of this bending die set, which is easy to construct. It bends a U-shaped piece from strip stock, and is designed to prevent the stock from being scored or damaged in any way.

The punch is relieved behind both bending edges, but a short length of straight side is provided at each corner. If the edge were sharper—if the relief were carried clear to the corner—die life would suffer.

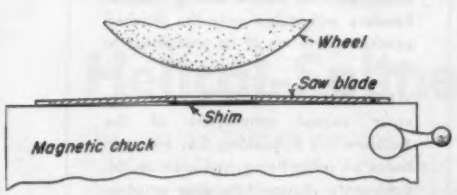
The die has a pressure pad, which helps the punch grip the stock as the ram descends. Two bending blocks make up the sides of the die; these rotate 90° as the punch goes down, pinching the metal to form a right-angle bend, but not scoring it because there is little sliding friction involved during a bend operation.

Each bend block is relieved like the punch, in the opposite direction, and each also has a short straight section to improve wear characteristics at the corner. The block is relieved on all four sides, and doesn't have to be indexed back 90° after a press stroke—but may be operated continuously.

Bending blocks are pinned into a yoked die member, and the pins are covered by side plates that prevent pin motion—and also allow quick disassembly if a part should be replaced.

Spacing between the punch in down position and the edges of the bending jaws is adjusted to let the stock be pinched, but not pinched off. Both rollers can rotate freely, and clear the punch, if stock is not inserted.

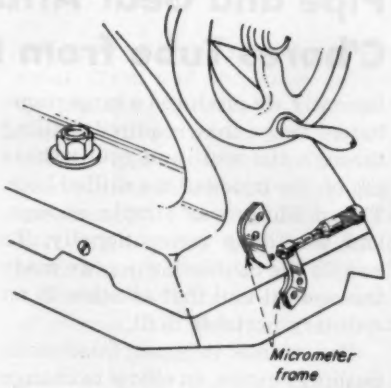
This die design allows considerable variation in stock thickness before action is impeded. It also flows the metal smoothly, produces bends without damage to stock, and provides long die life—partly because the bending blocks have four surfaces each. In addition, die parts are easily replaced. If necessary, the die can be adapted for stock of other sizes by changing bending blocks. *R J Every, Welling, Kent, England*



Shim and Magnetic Chuck Relieve Slotting Saws

This simple setup can be effectively used to relieve the center of circular slotting saws, of any thickness from 0.025 to 0.200 in.

Put the circular shim approximately on the center of the magnetic chuck, then put the cutter over the center of the shim. Apply the magnet, and the OD of the saw will be pulled down, leaving the center raised for grinding, to whatever thickness and clearance is desired. *Sebastian Milardo, Middletown, Conn*

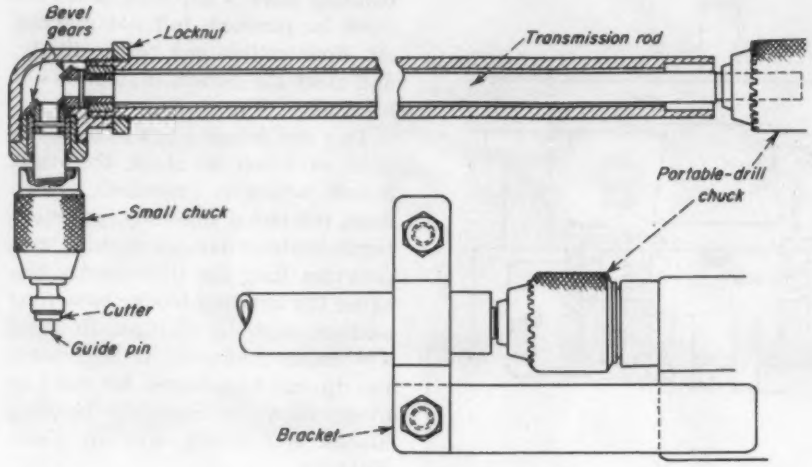


Tailstock Micrometer Aids Taper Adjustments

We've found that an inexpensive diecast micrometer can be cut in half through the frame and mounted on the tailstock to make an accurate centering and offsetting gage.

Both frame halves are bolted to the tailstock, with the barrel half on the bed, and the anvil portion on the movable block. They're located so the micrometer reads 0.500 when the tailstock is exactly centered, which allows ½-in. adjustments either way for taper work.

To avoid damaging the micrometer threads, we always back up the spindle, set the tailstock over, then run the spindle up to take a reading—never try to set over the tailstock against micrometer pressure. *Stanley Clark, East Bradenton, Fla*



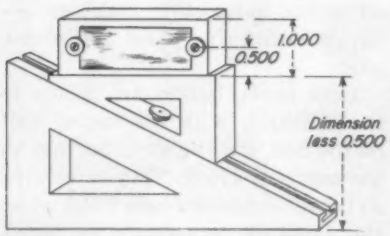
Pipe and Gear Attachment C'bores Tube from Inside

Recently we produced a large number of tubes that required drilling through the wall and counterboring on the inside of the drilled hole. The drilling was simple enough, and was done conventionally. To handle the counterboring, we made this special tool that attaches to an ordinary portable drill.

The frame is pipe, fitted with bushings inside, an elbow to change direction, and a set of small bevel gears. These were mounted on one long and one short ⅜-in. steel rod with locking pins. Support bushings were fitted inside the pipe frame to carry the rods and gears in mesh. One end of the longer rod was chucked at the portable drill, and the end of the shorter rod was fitted with a smaller chuck to take the counterboring tool.

This was a cutter made with a guide pin to fit the already drilled hole in the tube workpieces.

One additional attachment — a strip-metal bracket—was necessary to hold the pipe frame tightly to the electric drill. *W Lewis, Stockwell, London, England*



Test Piece Sets Height Gage

You can set a height gage to dimension as accurately with this method as with a vernier height gage. It requires a planer-shaper gage, a 1.000-in. thick block of steel, and a small piece of flat stock dyed with layout blue.

First you set the surface gage as closely as possible with a scale or whatever you have handy. Then lock the planer-shaper gage to the required dimension less 0.500 in. Mount the 1.000-in.-wide piece of steel on top of the planer-shaper gage, after clamping the dyed scrap to its side with small screws.

Now scribe along the piece of dyed scrap with the surface gage; turn the piece of steel over, and scribe again so both lines overlap a bit. If the surface gage has accidently been set to exactly the dimension desired, you'll have only one scribed line. If not, the two scribed lines will be separated by double the amount you have to adjust the height gage. *Arden Van Sickle, Homer, NY*

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ATTACHMENT AVOIDS BROKEN TAPS

for the best PRACTICAL IDEA

An extra payment of $25 is made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

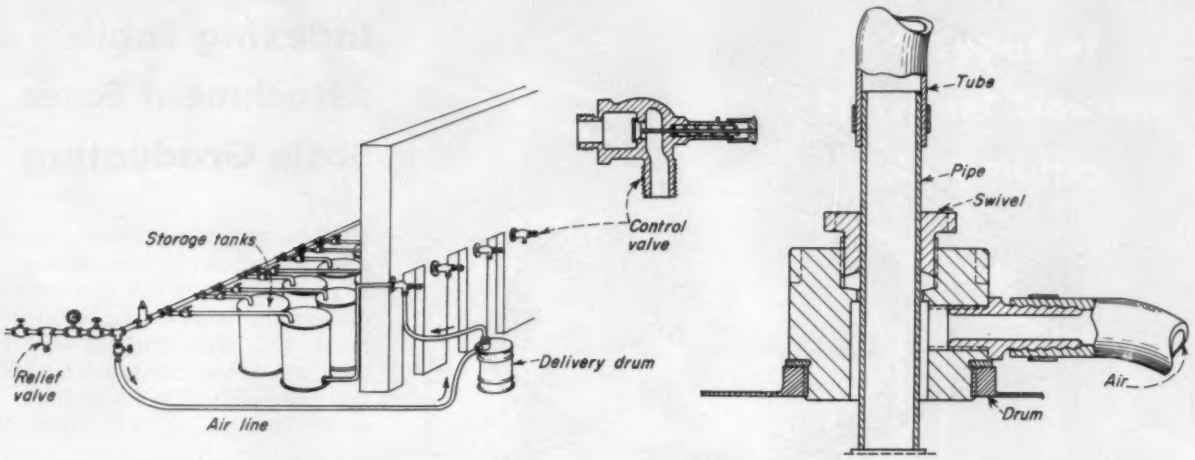
PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y



Air Pressure Aids Oil Transfer

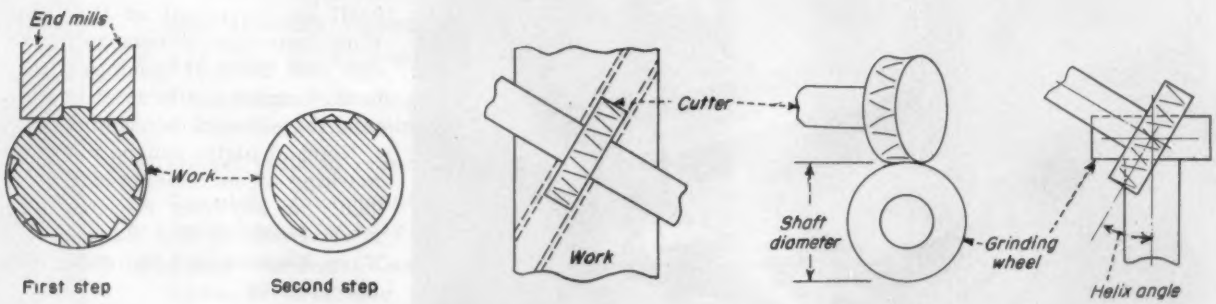
In our lubricating station there are several 130-gallon drums in which lubricants are stored for daily use. Oils are delivered in normal 52-gallon drums and immediately transferred to storage tanks, so the delivery drums can be returned.

We have solved the problem of oil transfer by using air pressure. Normally there is an effective pressure of about 4 psi in the storage drums, but each of these can be made pressureless by a 3-way tap.

When a 52-gallon drum has to be emptied, a transfer apparatus, consisting of a nipple which fits the drum to be emptied, is screwed into the drum. A pipe is pushed down through the nipple until it hits the bottom of the drum. This pipe is hermetically sealed by the swivel. Lines carry air to the small drum and oil from the small drum to the storage tank.

Then 4 psi air is admitted to the small drum and the knob on the oil transfer line is pushed. Air pressure forces the oil through the transfer line into the large storage tank, from which the 4 psi has been cut off. The knob has a bayonet catch, so it will hold itself open when pushed in.

The air used for pumping must, of course, be clean and dry. *J Hemmes, Hengolo(o), Holland*

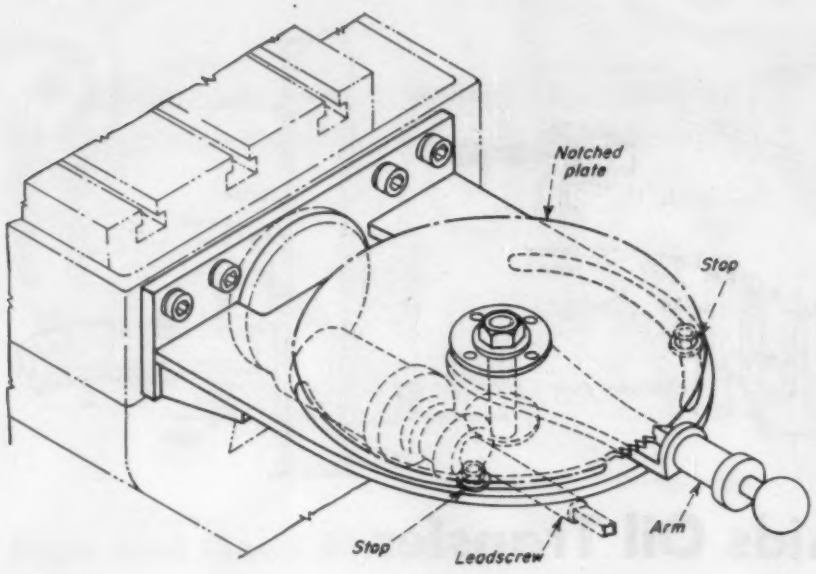


Helical-Spline Cutter Easily Ground

We had to produce four helical-spline shafts in a hurry, and didn't want to take the time (and spend the money) to make a splined-shaft milling cutter.

Instead, we worked out a quick, easy way around the trouble. First we milled the width of the spline with an ordinary end mill. Then, with an ordinary milling cutter provided with the correct radius, we finished the root diameter. To grind this cutter, without making the radius by computing and grinding it to shape, we dressed the grinding wheel to exactly the same diameter as the root diameter of the shaft. Then the cutter radius was ground in the same position as it would mill the spline grooves.

After grinding the clearance, leaving a small amount of circular land, the cutter was ready. *A Vetsch, Seuzach, Switzerland*



Indexing Table Attachment Eases Scale Graduating

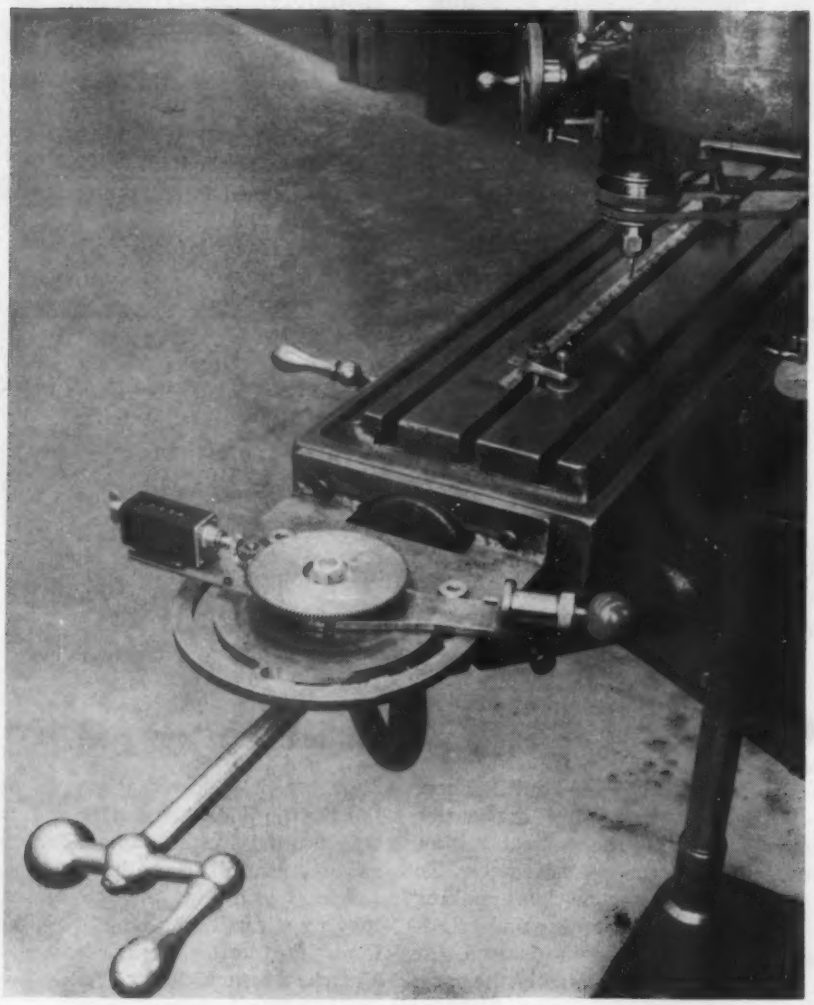
Marking up a longitudinal scale on a Gorton engraver is a tedious job if you only have the micrometer dial on the machine for measurement. This attachment drives the table leadscrew and allows picking any increment of table motion for which you can find or make a notched plate. You can even use an old gear, if it has the required number of teeth.

The plate mounts on a spindle held by a frame that bolts to the end of the table; and the spindle is geared to the leadscrew. Two stops in curved slots in the frame limit arm motion so you pick up the required number of teeth or notches each time you index. The stops are simply nuts and bolts.

The pawl in the arm should be spring-loaded to make sure it seats in each notch. If a gear is used, a special tooth-shaped pawl can be installed.

The counter (see photo) was installed to allow marking up a logarithmic scale; it reads every 0.001-in. movement of the table. With base-line dimensioning we can read unequal spacings direct; or the counter can be reset to eliminate base-line dimensioning.

Notched plates can be made for marking off increments of 1/64 or 0.001, or anything else required. *A A Arnold & F J Hansen, U S Navy Electronics Laboratory, San Diego, Calif*

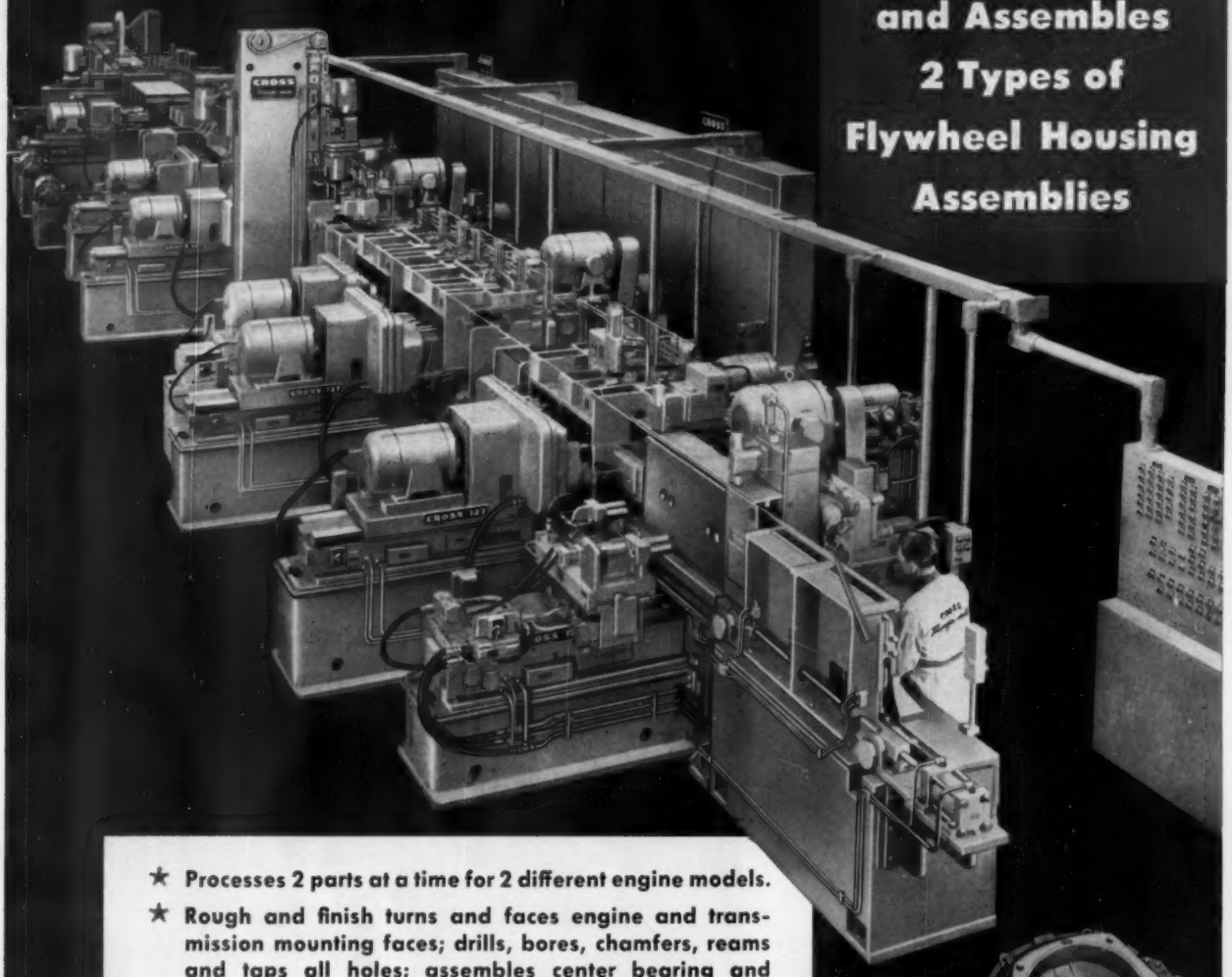


Grinder "Shapes" Hardened Work

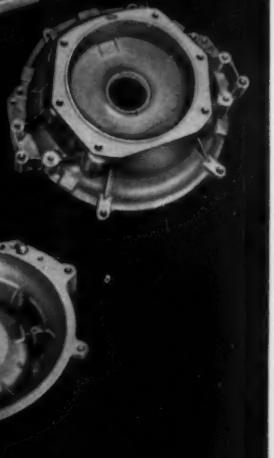
Mount a bracket on the shaper clapper box, to hold a toolpost grinder. This tool can then be used to cut slots in hardened work, and to do similar jobs that can't be done with the conventional shaper tools. *Jack Dalton, Edgewater, NJ*

Another Transfer-matic by Cross

Bores, Faces, Drills and Assembles 2 Types of Flywheel Housing Assemblies



- ★ Processes 2 parts at a time for 2 different engine models.
- ★ Rough and finish turns and faces engine and transmission mounting faces; drills, bores, chamfers, reams and taps all holes; assembles center bearing and 2 dowels; finish bores and inspects center bearing after assembly; washes, dries parts for final assembly.
- ★ 314 pieces per hour at 100% efficiency.
- ★ 20 stations: 1 loading; 10 machining; 2 assembling; 4 inspecting; 2 cleaning; 1 unloading.
- ★ Pre-set tools to reduce downtime for tool changing.
- ★ Complete interchangeability of all standard and special parts for easy maintenance.
- ★ Other features: Construction to J.I.C. standards; hydraulic feed and rapid traverse; hardened and ground ways; automatic lubrication.



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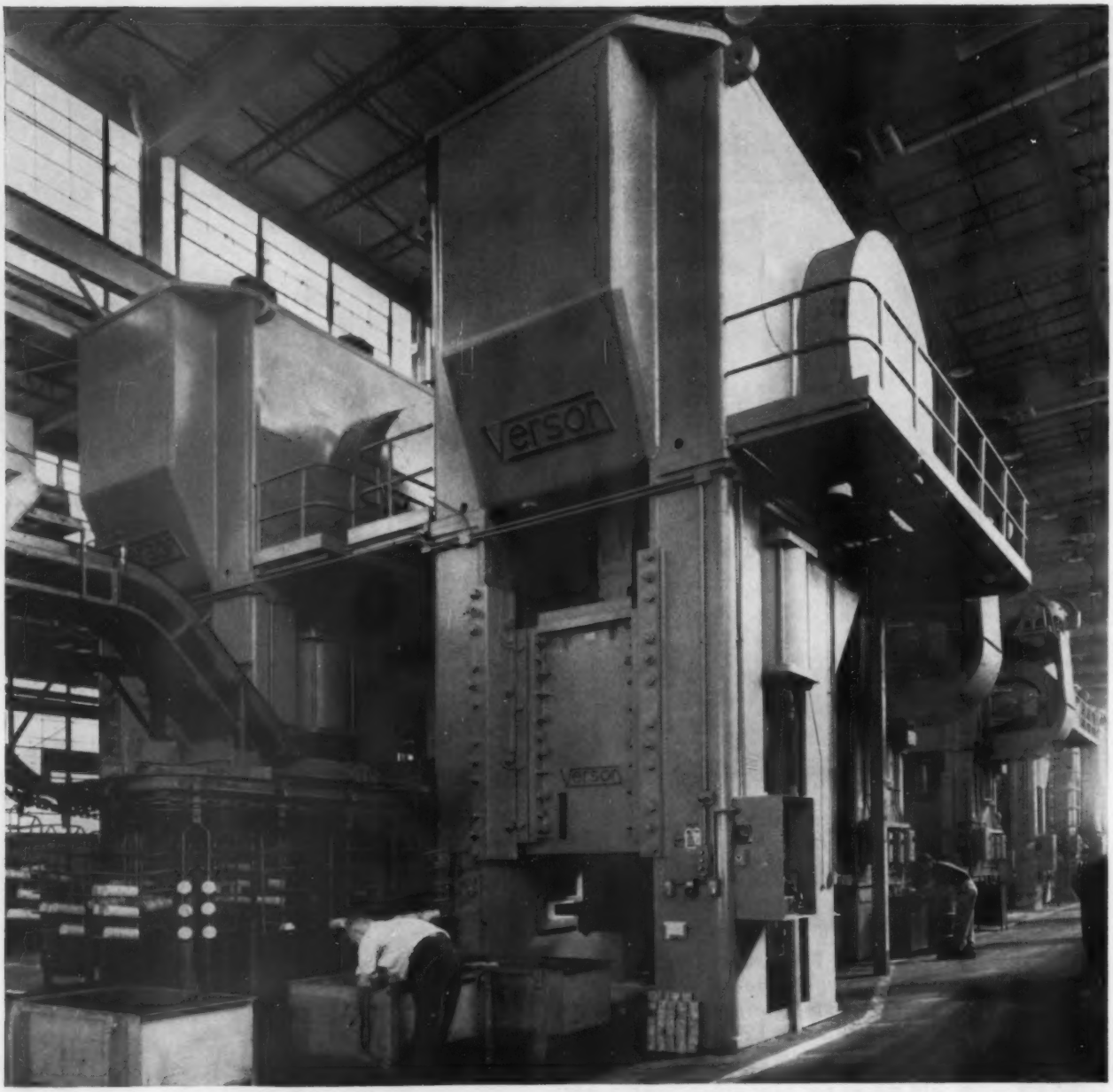

Verson

ECCENTRIC PRESSES head the line at Heintz Manufacturing Company

● The two Verson Eccentric Presses illustrated above are each rated at 1500 tons with 4500 tons drive capacity. The presses are a key part of the cold extrusion lines at Heintz Manufacturing Company, Philadelphia, said by many to be "the birthplace of cold extrusion of steel in America." Both presses are specially designed with fast operating speeds to fit the production process.

Like all Verson Eccentric Presses, these represent the ultimate in mechanical press design. They provide power, strength, resistance to deflection, accuracy and efficiency unmatched by any other mechanical presses. This design coupled with Verson production know how means that when you select a Verson press, you get more than just a press. You get a production tool, tailored to your requirements as an integrated part of your production process.

It will pay you to take advantage of Verson experience in the expansion or modernization of your facilities. With a long list of advancements to its credit, Verson may be able to show you the way to lower unit production costs. For specific recommendations, send an outline of your requirements.

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PROPER STORAGE OF COATED ABRASIVES

COURTESY MINNESOTA MINING & MFG CO

The right combination of controlled temperature and humidity keeps coated abrasives at their optimum grinding and finishing efficiency, and assures ease of handling and use.

Climatic conditions may have an effect on any coated abrasive at some time or other, whether the user is located in what is normally a "dry" climate or one which is generally thought to be "damp".

Continuous studies indicate that ideal storage conditions include:

1. A constant storage temperature between 65 and 75 F.

2. A controlled relative humidity between 35 and 50%.

Generally speaking, efficiency of coated-abrasive grinding and finishing increases as humidity decreases. However, when a coated-abrasive product is allowed to dry out too much, brittleness, cupping and difficulties in handling nullify the advantages of increased cut. At between 35 and 50% relative humidity, coated abrasives offer the best combination of cutting efficiency and ease of handling.

Poor storage conditions may effect coated abrasives in one or more ways. Excessive humidity, for example, may cause a softening of the bond (particularly in the case of glue bonds) so that when the mineral grains are presented to the work they tend to push into the backing or lay over on their sides instead of penetrating the work.

Excessive dryness, on the other hand, causes brittleness which creates difficulties in handling; possible mineral loss due to the brittleness of the bond, or convex cupping (that is, with the mineral side out) because of shrinkage of the backing as it dries out.

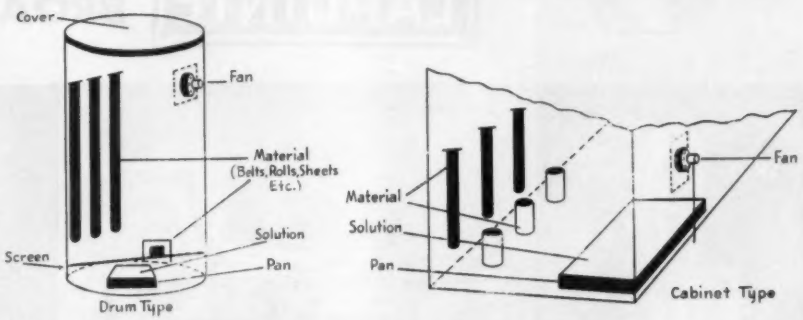
These storage recommendations are offered:

1. Store coated abrasives on pallets, in bins or on shelves, out of direct sunlight.

2. Leave the coated-abrasive materials in original packages until ready for use, to modify the effects of rapid changes in temperature and humidity.

3. Avoid storage areas subject to alternate hot and cold, or wet and dry cycles.

4. Store coated abrasives away from heating equipment or steam lines.



Humidity Control Units for Coated Abrasive Storage

These simple storage precautions will pay off in continued optimum service from coated abrasives. For example, glue-bond papers have been stored for 10 yr at approximately 50% relative humidity and 70 F without noticeable deterioration.

For geographical locations subject to rapid or extreme seasonal changes good storage can be provided by use of cabinets or rooms, depending on volume of coated abrasives consumed. Such facilities range from a 55-gal drum or airtight metal cabinet to a walk-in unit.

A small conditioner is made by placing an enameled pan about 9x18x2 in. in the bottom of the drum or cabinet. The pan will hold a saturated solution of a humidity-control chemical mixed with water. A heavy screen is placed over the pan to prevent the coated abrasives from touching the solution. Necessary air circulation is provided by installation of a small fan.

The cover should fit tightly, yet allow easy access. Flat-type stock (such as sheets and disks) are placed on the screen for conditioning; short belts are hung on hooks attached to the inside of the barrel.

It takes at least three days to condition coated abrasives that have been affected by humidity. Therefore, it is necessary with the smaller type of unit to anticipate future needs for coated abrasives and place them in the conditioner accordingly.

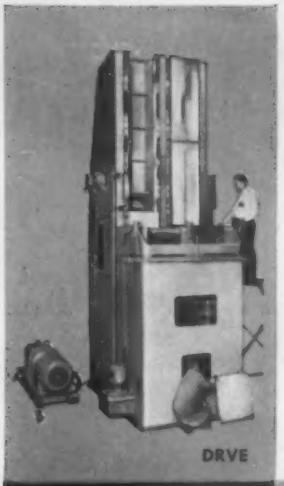
Potassium carbonate is a highly effective chemical for humidity control, because its humidity range centers at about 43%, it is low in cost, and it can be handled easily with normal caution. One tray of potassium carbonate properly maintained in a saturated solution will control between 40 and 50 cu ft of air.

Other relatively harmless chemicals and the humidities which can be expected from each are calcium chloride, 32%, and sodium dichromate, 52%.

Where coated abrasive consumption is such that a walk-in storage unit is desirable, it is advisable to call in air-conditioning specialists to make recommendations for proper equipment.

For checking humidity readings, a direct-reading humidity instrument is acceptable; however, a stationary wet-and-dry-bulb humidity gage is the most effective instrument. Wet and dry bulb readings are simply converted to relative humidity.

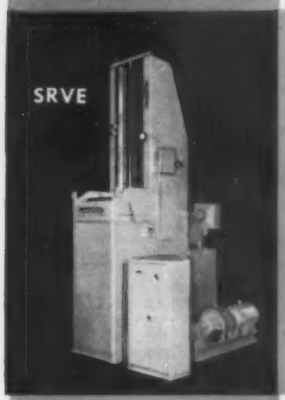
In the large room, relative humidity is most accurately measured with a sling psychrometer.

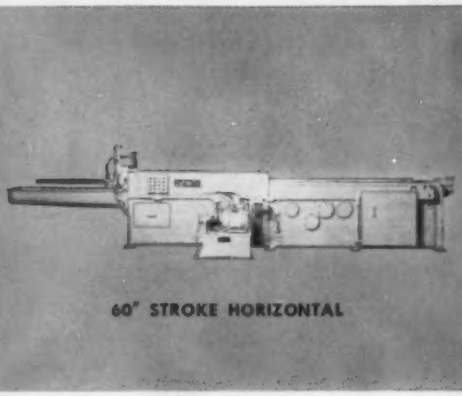


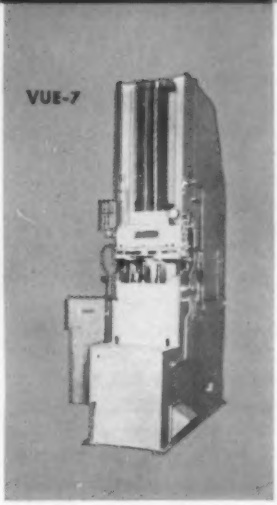
what BROACHING NEWS created the *greatest interest* in Chicago, at the MACHINE TOOL SHOW

. . . if you were there, you know

it was the 5 electro-motive drive LAPOINTE BROACHING MACHINES!







The 3 vertical machines and the 2 horizontal machines developed by LAPOINTE with electro-motive drive embody the world's greatest advances in the history of broaching. These machines, in fact, can represent *the most productive floor space in your plant!*

Just why is everyone — especially automotive — turning to the *electro-motive drive* for broaching?

- **Amazing increases in production**
  Broaching speeds up to 300 feet-per-minute (and more) have scrapped all previous concepts of production output!
- **Elimination of chatter**
  Smooth, powerful drive through a mechanical bull gear rack eliminates all chatter and substantially improves quality of work.
- **Permits carbide tooling**
  The high speeds and smooth operation make carbide tooling completely practical.
- **Prolonged tool life**
  Increases of 400% to 500% in tool life, between grinds, reduce downtime and show real dollar savings in tools.

Send for descriptive literature on all 5 LAPOINTE ELECTRO-MOTIVE DRIVE Broaching Machines.

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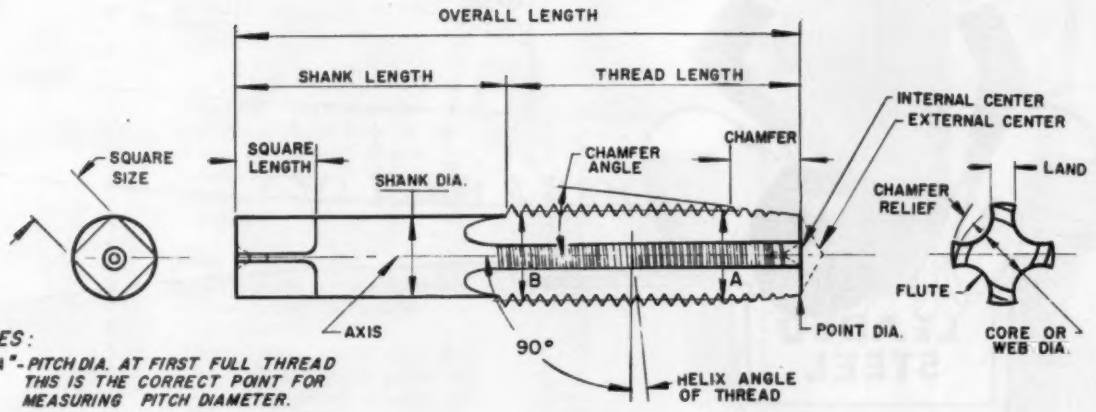
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

TAP TERMS ILLUSTRATED

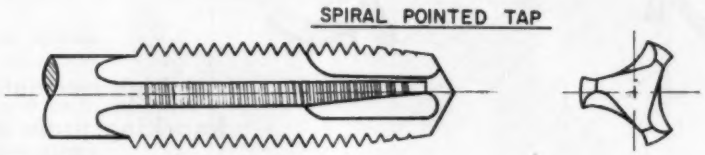


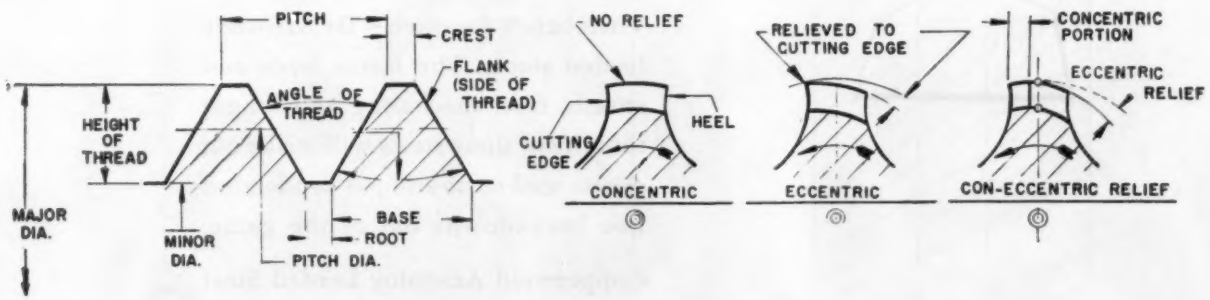
NOTES:

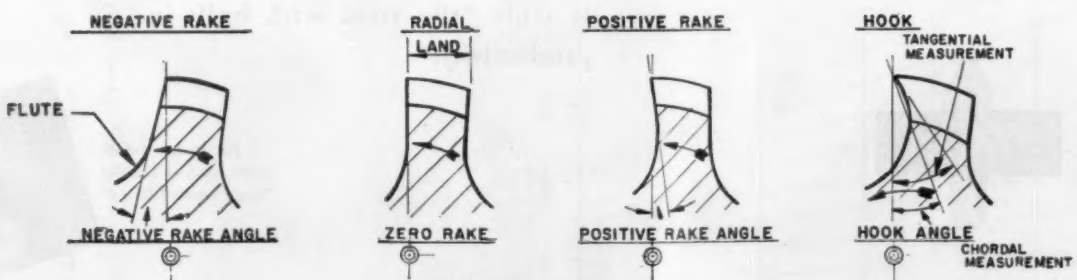
"A" - PITCH DIA. AT FIRST FULL THREAD THIS IS THE CORRECT POINT FOR MEASURING PITCH DIAMETER.

BACK TAPER— THE AMOUNT PITCH DIA. AT "A" IS GREATER THAN PITCH DIA. AT "B"

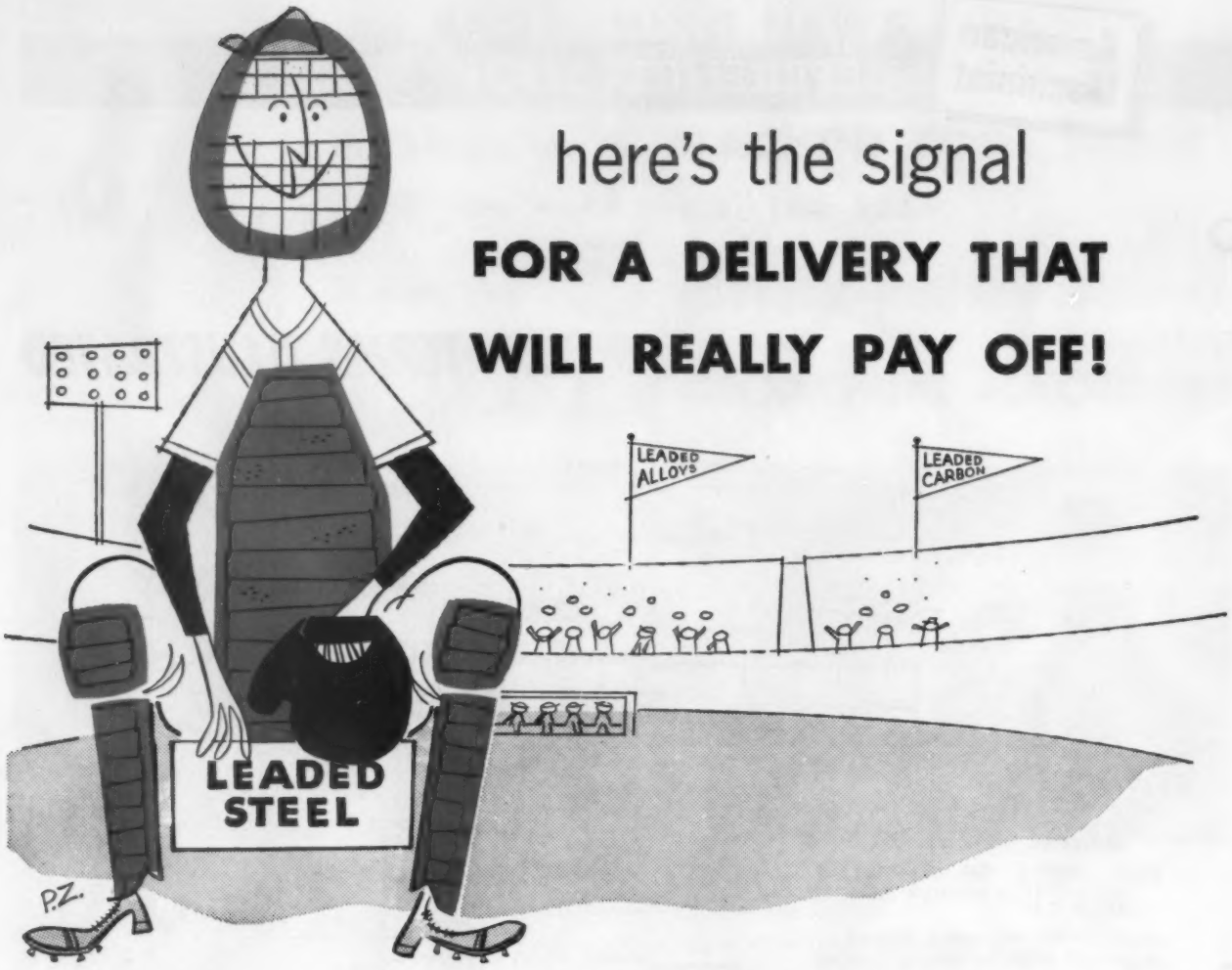
LEAD = PITCH FOR SINGLE THREAD
LEAD = 2 X PITCH FOR DOUBLE THREAD
LEAD = 3 X PITCH FOR TRIPLE THREAD







CUTTING FACES



here's the signal

FOR A DELIVERY THAT WILL REALLY PAY OFF!

Are high machining and tool costs knocking profit out of your daily battle for quality production?

Then here's the pitch—Try Aristoloy leaded steels. The faster feeds and speeds, freer machining and longer tool life of these steels will strike out excess tool costs and put production line breakdowns out of the game.

Copperweld Aristoloy Leaded Steel is truly "the steel with built-in productivity."

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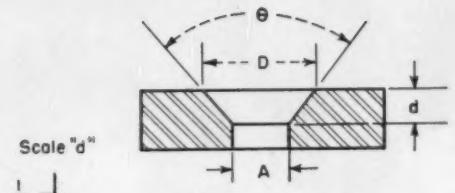
COUNTERSINK DIAMETER AND DEPTH CHART

DONALD E SWEET, tool engineer



When a hole is countersunk in machine part, there are often restrictions on the diameter or depth of the countersink. Use of the scales on this chart simplify the calculations for these variable dimensions.

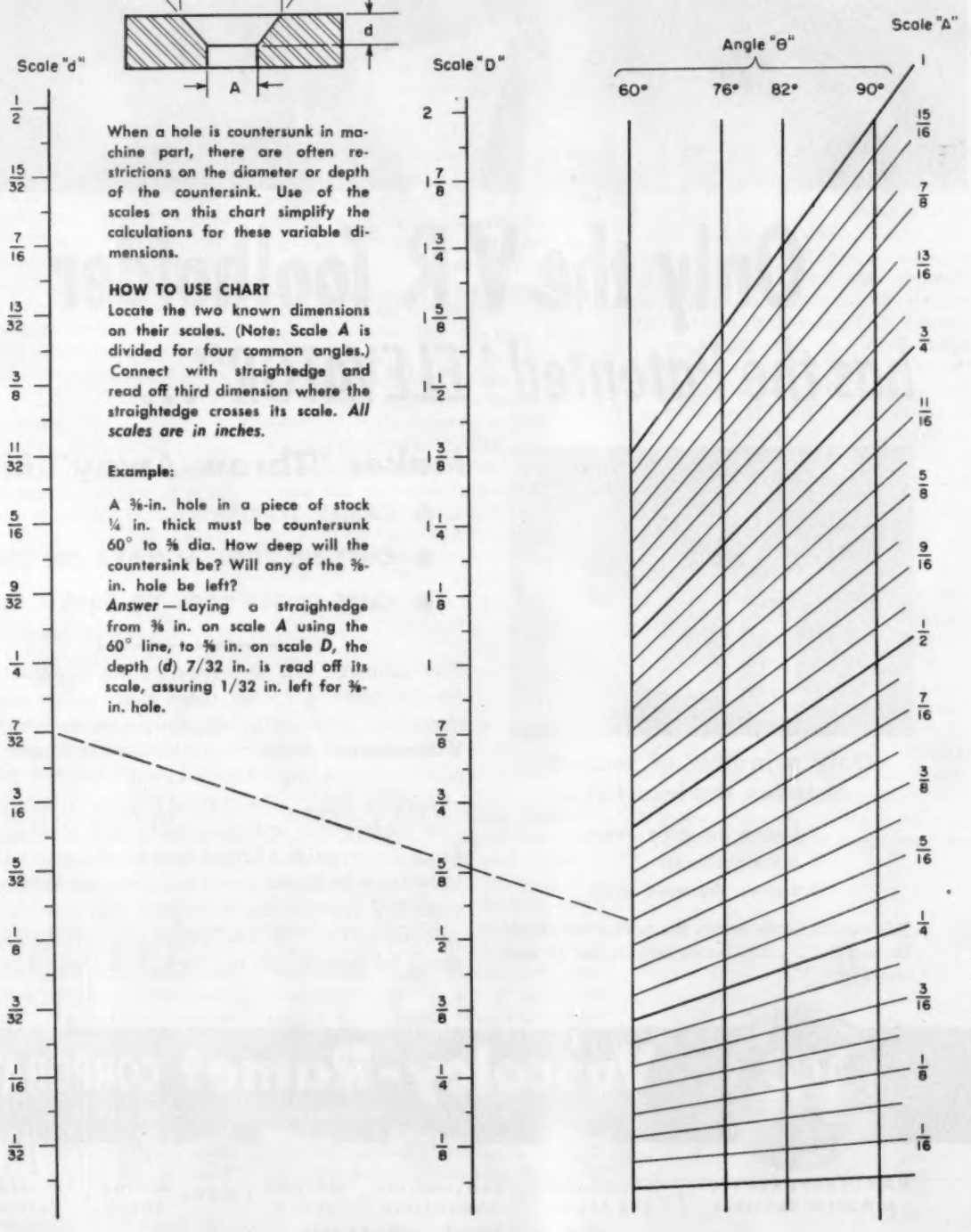
HOW TO USE CHART

Locate the two known dimensions on their scales. (Note: Scale *A* is divided for four common angles.) Connect with straightedge and read off third dimension where the straightedge crosses its scale. ***All scales are in inches.***

Example:

A ⅜-in. hole in a piece of stock ¼ in. thick must be countersunk 60° to ⅝ dia. How deep will the countersink be? Will any of the ⅜-in. hole be left?

Answer — Laying a straightedge from ⅜ in. on scale *A* using the 60° line, to ⅝ in. on scale *D*, the depth (*d*) 7/32 in. is read off its scale, assuring 1/32 in. left for ⅜-in. hole.



V-R Exclusive "Elevator" Invention Cuts Tool Cost

Only the V-R Toolholder *has the Patented "ELEVATOR"...*

Only a matter of seconds to index the insert . . .

1. Loosen the main screw
2. Index the insert
3. Tighten the main screw

This automatically brings the cutting edge back to center . . . eliminates adjustment of tool shank.

Makes "Throw-Away" Blanks

- **EASIER TO USE**
- **CUTTING EDGE *ALWAYS* ON CENTER**
- **CUTS COSTS 35% TO 50%**

The exclusive V-R elevator provides an adjustable base for the insert . . . saves down time, makes indexing or changing inserts a quick, simple operation. Only the V-R patented elevator permits the use of any length of carbide, including "Throw-Away" blanks. Regardless of carbide length, the cutting edge is always on-center. The replaceable and reversible tool steel elevator is ground to provide a firmer base for the insert and, at the same time, locks the insert solidly in the toolholder. Ask your V-R representative to show you how the patented elevator of the V-R Toolholder can save you money, or write for details and the New V-R Toolholder catalog.

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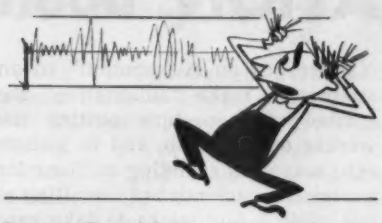
Talking Shop...



Power Trouble

IN SPITE of booming production in Great Britain, manufacturers are still faced with the specter of inadequate power supplies, and the government is encouraging the use of private generating facilities to reduce peak loads for the coming winter. Consumers are advised that "unless there is weather of 'extreme severity' no disconnection of supply should be necessary, although voltage and frequency reductions will still be needed on some occasions." How'd you like to try running an automated plant, with its hundreds of relays and other sensitive equipment, under such conditions?

$12,500 to Hire

IT COSTS $12,500 to hire a man these days—at least in terms of plant investment. Machinery & Allied Products Institute estimates that a company must have a capital investment of that amount for every worker.

Cheaper Atomic Power?

ALUMINUM, used extensively as a fuel-cladding metal in nuclear reactors, is fine up to 400 F. Above that, corrosion shifts to a penetrating attack, forming mixed metal and oxide at an accelerating rate. Above 600 F, the corrosion is rapid. This has forced use of zirconium and other costly metals, increasing reactor costs. Dr J E Draley and W E Ruther of the Metallurgy Div, Argonne National Labs, Lemont, Ill, found that penetration is caused by hydrogen released in the corroding process. Two methods have been developed to stop it. The first is to incorporate small amounts (½ to 1%) of nickel and iron in the aluminum; this stops penetrating corrosion in water up to 660 F. The second is to add minute amounts of nickel sulfate to the water, made acidic by the addition of sulfuric acid. This protects commercially pure aluminum to 530 F.

Soviet Anode Saw

THE SOVIETS are reported from Vienna to have developed a bandsaw for metals that works on "the anode-mechanical principle and is roughly a combination of a woodworking bandsaw and a lathe." It will cut blocks up to 350 mm (13.18 in.) thick, 750 mm (29.52 in. wide), and 1200 mm (47.24 in.) long. "Blade" material is steel wire (up to 0.078 in. dia) or band (0.236 x 1.18 in.), 18 ft long. Table is either on rails like a lathe carriage, or on rotary ways like a boring-mill. Surface speed is 20 meters per sec (65 fps), according to the report—which is claimed identical to that "cutting wood with a bandsaw." The band carries 24 to 27 volts and 400 amp, but can handle 50 to 100 times that current for short periods. The negative connection is to the upper bandwheel, positive to the table, which is insulated from the machine frame. Cutting feed is 0.039 to 1.968 ipm. Cutting fluid (water glass with 4 to 6% mineral oil) floods the work, is collected at the lower bandwheel.

The machine is credited with major advantages over disk cutters, because the disk has caused shorts at sides in angle cutting of large objects, according to *Stanki i Instrument*, unless feeds are cut, reducing productivity. The machine uses a 15-kw motor, weighs 2½ metric tons.

No Creep

URANIUM, like other metals, tends to grow or creep under heat. In a reactor, the core may change shape or size—and that means trouble. A uranium rod may actually double in length after having lost only one atom per thousand. Study indicates the growth under irradiation is a function of fabrication method, fabrication temperature, and chemical composition. Castings elongate much less rapidly than most rolled types. Uranium rolled at 575 F grows in length much faster than that rolled at higher temperatures—in fact, if rolling temperature is high enough, the metal may actually shrink under irradiation. Such alloying elements as silicon, chromium, zirconium, niobium and molybdenum can cut growth. Large grain size will cause a rough surface, and these alloys reduce grain size. Sometimes, post-rolling heat - treatment reduces the growth.

Do any of these factors have application in creep of steel?

Moly at Work

PONTIAC makes the M-39 convertible rapid-firing cannon for the Army. Orifices in the barrel of the gun are screwed in before the rifling is broached, yet must withstand high heats. Molybdenum looked like the right material—good strength at high temperature, machinable, available—but it cracked when the broach hit it. Fansteel Metallurgical found, however, that adding a little cobalt to it ended the breakage. The powder-metal alloy is sintered as a bar, then hot-rolled and swaged. Sections are abrasive-cut off, centerless ground, heat-treated, inspected, center-drilled and one end, faced and chamfered. The part is bored, then finished on the other end, roll-threaded to Class 3 fit and faced to length. The screw slot is ground in with an abrasive wheel. Boring is done with HSS tools, turning and facing with carbides.

Papuh, Mistuh?

RIEGEL PAPER CORP, NYC, has a new paper very resistant to oil, water, and other liquids, but passing air freely. Suggestions for use of it include cooler raincoats (that are also disposable?) popcorn bags that won't leak grease (and can't be blown up and popped in theatres). Sounds good for wrapping metal parts—except for the air passing through. Like silicones and gun bluing, now that it has been developed, some use must be found for it.

News of Metalworking . . .

SENATE TO PROBE AUTOMATION: Boon

It'll be Walter Reuther against all comers — and there'll be some big names from industry as pro-automation witnesses — when the Patman hearings open in Washington this week

WASHINGTON — Automation hearings slated to get underway on Capitol Hill this week will take a long, hard look at the impact of automaticity on Metalworking. Lined up to do battle over the question "will automation put people out of work?" will be top U S industrialists on the "no" side and top labor leaders on the "yes" side. The battleground will be the chambers of the Patman Subcommittee of the Joint Committee of the Economic Report, beginning October 14.

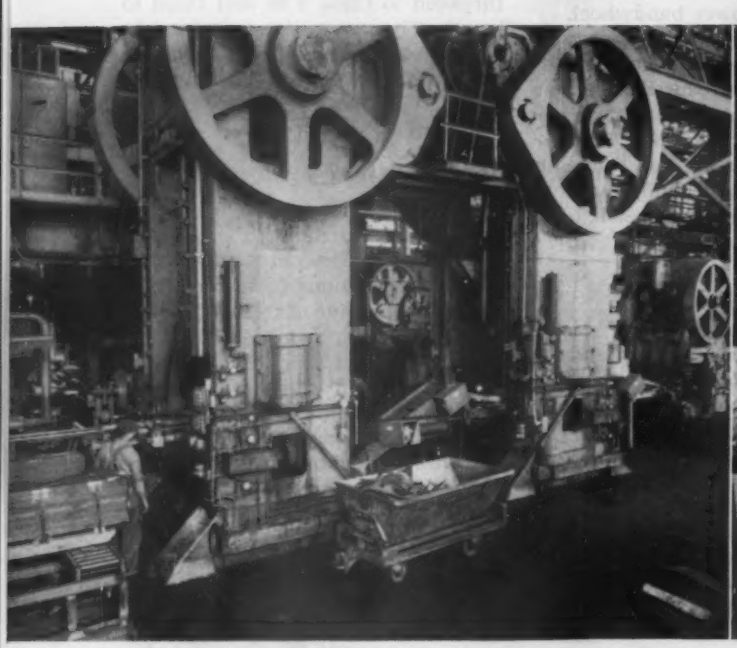
The Patman Subcommittee plans a fact-finding study of the impact that automation will have on employment, personnel displacement and readjustment, stability of employment, and effect upon costs and investment. This Congressional look-see at automation was promoted by the CIO's Walter Reuther back in April. Then, he was beating the drums for a guaranteed annual wage, hadn't yet had his showdown with Ford and GM.

At that time, CIO sponsored a "Conference on Automation" in an attempt to make "automation" the symbol of a machine putting the worker out of a job, and to picture auto magnates spending millions for automatic machines but unwilling to put aside a few bucks to take care of the worker tossed out on the scrapheap.

Reuther and O'Mahoney

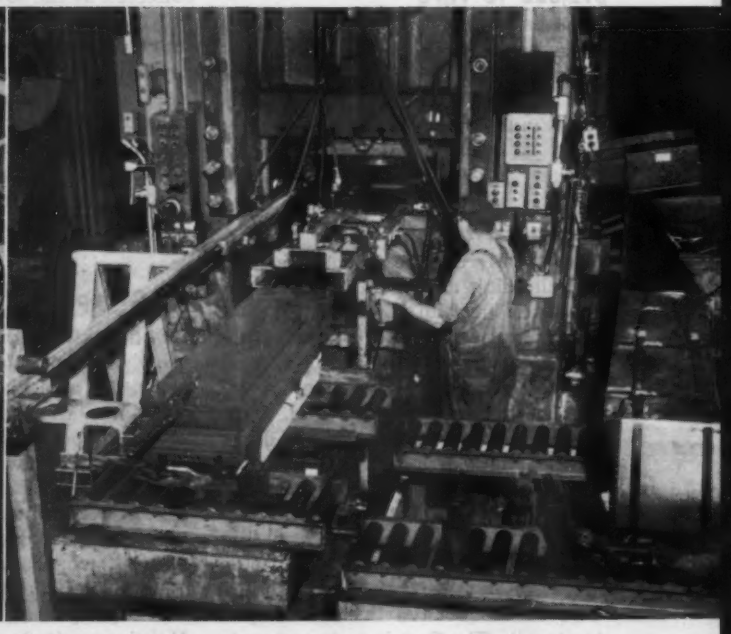
Wyoming's Democratic Senator Joseph C O'Mahoney, who incidentally was principal speaker at the CIO conference, is a member of the Patman subcommittee and went along with Reuther's suggestion that Congress do a little investigating along these lines. He'll sit in on the hearings along with Rep Wright Patman (D, Texas), the chairman; Sen

One Operator Controls Three Presses



Manual handling is eliminated . . .

on this progressive press line that stamps SAE 1008 steel converter pump covers for Dynaflow transmissions at Buick's sheet metal stamping plant. First, a 1500-ton Cleveland press blanks, forms, and pierces a pilot hole in ¼-in. stock. A second 1500-ton press restrikes the cover, and a 60-ton press pierces center hole. One man controls the entire operation



Flight conveyor removes scrap . . .

from first press's scrap cutter to scrap cars. Stamped blank is ejected from die through slides and into chute to another portable wire-mesh belt conveyor that delivers it to second press. Then blank drops into a nest where it contacts limit switches controlling air-actuated slide that feeds blank into die and returns, automatically starting press stroke. Switches control press cycle, prevent loading die with more than one part

or Bugaboo to the U S Production Worker?

Arthur V Watkins (Rep, Utah), and representatives Augustine B Kelley (D, Pa), and Jesse P Wolcott (R, Mich).

Industry and labor leaders, including Walter Reuther, will be witnesses at the hearings, which will cover Metalworking, electronics, transportation, office management and chemicals.

All-Star Witness Lineup

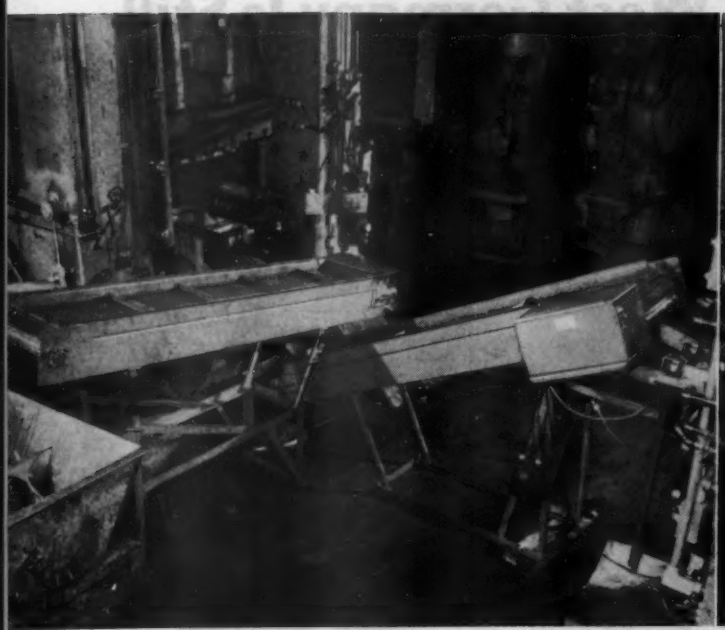
Witnesses from Metalworking will include D J Davis, Ford vice president, who will testify on the opening day; Robert C Tait, president of General Dynamics Corp's Stromberg-Carlson Division; John I Snyder, Jr, president and board chairman of U S Industries, Inc; and a representative yet to be named from Studebaker-Packard. For each industrialist, the subcommittee hopes to have a labor leader as opposition witness.

General witnesses will be scheduled, too, such as Economist Edwin Nourse, chairman of the Council of Economic Advisors under President Truman; and Vannevar Bush, president of Carnegie Institution and World War II's Office of Scientific Research and Development head, who will discuss the place of innovation and technology in the free enterprise system.

The subcommittee has also arranged with Labor Secretary Mitchell for results of Labor Dept studies of a series of case histories, and an analysis of problems that have arisen in metalworking plants and other installations as a result of automation and technical progress.

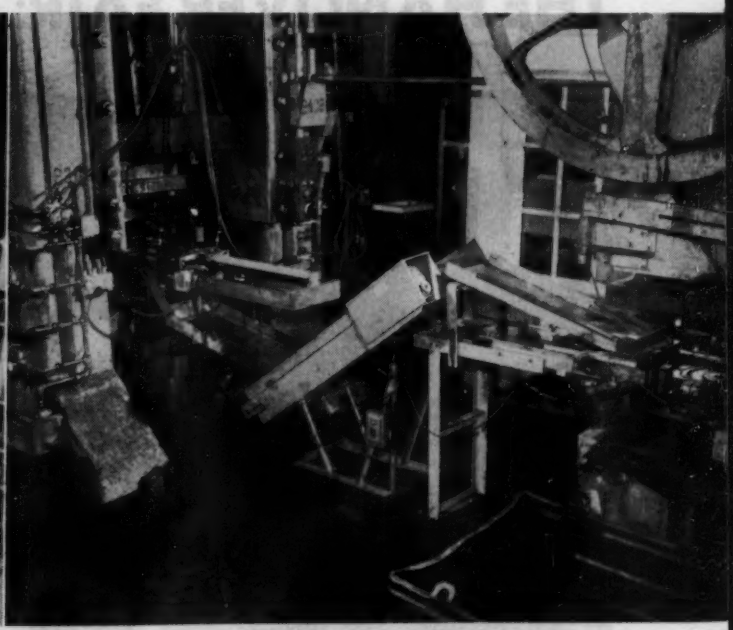
While industry can be considered unanimous in its pro-automation attitude, labor is far from unanimously against it, as CIO's April Conference plainly showed. Actually, many a labor leader thinks, along with officials of government and industry, that the continued investment of industry in more productive machinery is the best guarantee of more employment and better employment at higher wages. As Senator O'Mahoney told the CIO Conference, ". . . the entire population of the U S now has the opportunity to see clearly that the pushbutton industrial system has such widespread effects upon our whole social, economic and political structure that a Congressional study is necessary."

on Buick's Progressive Press Line



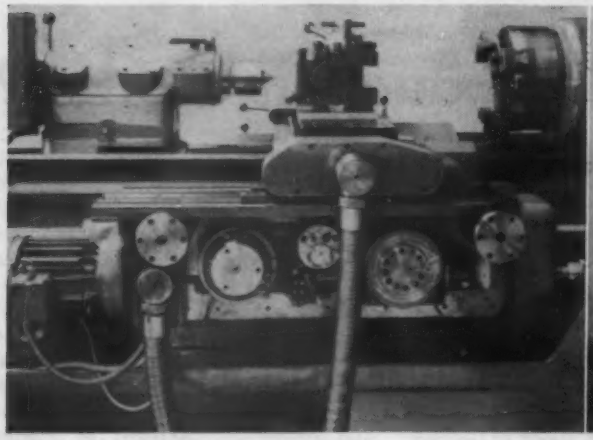
Transverse roller conveyor . . .

feeds stock to elevating platform at first press. Pushbutton controls actuate elevator to raise stack of blanks to align with automatic feeder. The 15⅛x60¼ in. blanks are delivered one at a time by an air-cylinder-driven arm. Each blank produces four pieces. Air-cylinder-driven loader feeds blank into die for one-fourth of its total length. Limit switches control positioning, prevent misalignment



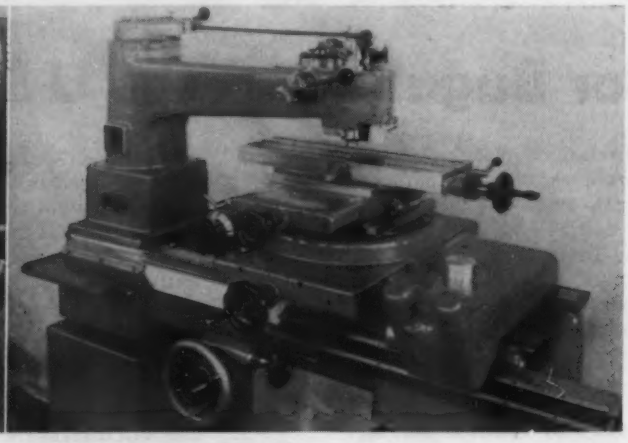
Air-actuated hook ejects part . . .

from second press into chute to deliver part by conveyor to third press. No scrap is produced in restrike operation in second press, but center hole pierced to final size in third press produces ring-shaped slug that drops through bolster onto belt conveyor for transfer to scrap tub. Finished covers are ejected onto another conveyor at rear of press for delivery to subsequent operations



Automatic screwcutting unit . . .

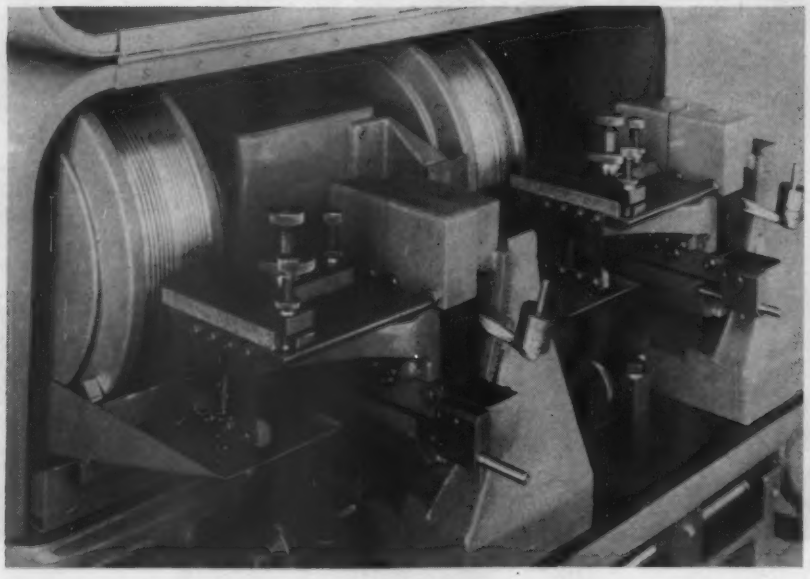
fitted at the rear of a Hasse & Wrede lathe is designed for rapid threading with carbide tools by providing automatic sequence of passes, tool withdrawals, and rapid returns of the saddle until thread is cut to correct depth. Unit has its own leadscrew, actuates saddle traverse through a rack. At end of each pass, leadscrew is uncoupled from work spindle and reversed by separate motor to give constant rapid-return rate of 2 in per sec. Tool always starts again at correct point. Pressure from lubrication pump also holds follower to templet for tapers



Templet milling machine . . .

developed by Studer for cutting sheet metal templets for copy machining works on a coordinating principle. Main longitudinal and cross slides have precision scales with microscopes and graticules reading to 0.0004 in. Above main slides is a rotary table and auxiliary slides for bringing centers of arcs to center of table rotation without unclamping work. Cutter spindle takes a centerpunch for marking out coordinate points, and centering microscope provides for setting cutter to the marks. Machine has 19.6 x 5.9-in. table area, mills material up to 0.19 in.

THE HANOVER FAIR: West Germany Is Still

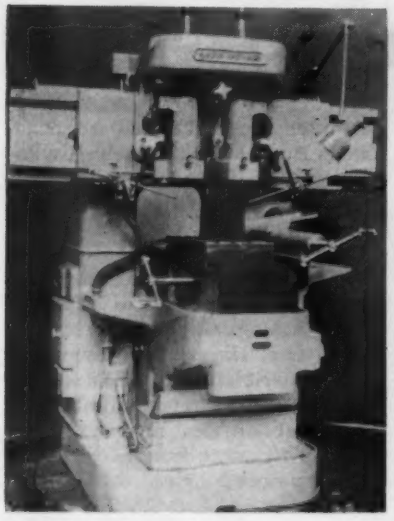


Profile lapping machine for carbide tools . . .

was shown by Wanderer-Werke. Lapping element is a steel ring precision ground to the required profile and rotating on a drum at 98 fpm while flooded with lapping fluid. Tool is held in a carrier mounted on flat springs to allow tool to position itself with relation to the form of the lapping ring. Carrier is weighted to maintain pressure between tool and lap. Time switch permits machine to run for predetermined period without operator attention. A model is available with indexing equipment for lapping inserted-tooth cutters

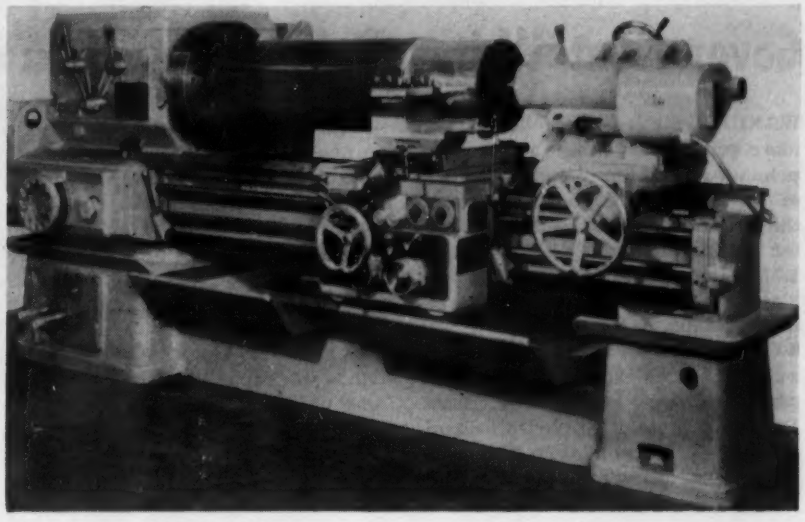
Wheelhead turns 360° . . .

on this Reinecker WZS-3 universal cutter grinder on both horizontal and vertical axes, allowing wheel to be set for helix angles from 0 to 90°, and relief angles from 0 to 30° for right and left hand cutting. Any number of divisions from 2 to 30 can be obtained



2-spindle copy miller . . .

traces with stylus in fixed relation to cutter. This quickly resettable Fritz Werner machine can be used to mill steels and light alloys because of closely stepped and high spindle speeds. Double spindle allows making two pieces simultaneously



Variable center height . . .

of this Heid Neomat universal lathe is achieved by mounting headstock and tailstock on 45° slides so that machine capacity can be increased 85% in a matter of minutes. Machine can be arranged as a universal, production, or short-bed lathe, and it may be equipped with electric copying attachment, turret, relief turning and relief grinding attachment, fine turning attachment, and drilling tailstock. Machine is made in various sizes, the model shown having a spindle height range of from 11 to 15¾ in.

Coming Up with Machine Tool Ideas

HANOVER, WEST GERMANY — While there weren't any turnstiles to count them, thousands of European industrialists turned out for the annual Hanover Fair in September to see machine tools and equipment exhibited by some 550 West German builders, plus 27 from Switzerland, 14 from Austria, three from Sweden, two from Belgium, four from Italy, two from The Netherlands, and one each from England, France, Lichtenstein and Luxembourg. Reaction of visitors, in the main serious-minded buyers: "it was well worth coming to this year's Fair."

Much of the equipment shown was new and exhibited for the first time, and there was a notable trend toward automatic operation and the use of programming. Stepless speed control and constant surface speeds were noted on many machines.

In addition to the machines illustrated above, other exhibits included a new Pittler turret lathe featuring constant surface speed for facing, an operation performed by rotating the turret, and a single-spindle chucker with a 20-in. swing on which the sequence of speed changes and spindle reversals is set up on a program drum. Fortuna-Werke showed a cylindrical grinder with fully automatic work-loading unit and sizing device, and Otto Mueller demonstrated a mobile version of their high-speed radial drill with ball-bearing roller guides for the arm, stepless speed control, and power elevation of the column. Wilhelm Fette displayed a universal hob measuring machine developed originally for measuring the company's own precision hobs and involute gears, and Maschinenfabrik Walter Woelfel showed a vertical drill with a speed range from 45 to 4500 rpm, suitable for milling, drilling, and reaming.

A Schuler press featured an electric clutch capable of stopping the ram at any point in the stroke in less than one-tenth second without any shock effect. Two relieving lathes by Albert Strasmann were fittted with Leitz projection microscopes for setting and measuring operations against a master profile drawing. A Schroeder jig borer featured magnetic speed control with a claimed efficiency of 94%.

An unusual roller shear, by Wagner, Dortmund, is capable of cutting steel plate ½-in. thick and up to 26 ft long. A planing attachment permits machining the edge for any type of welding. Operator rides on a saddle with the planer tool. A similar machine will shear 1-in. plate 49 ft long.

A two-spindle deep-hole drill with speeds up to 6000 rpm for carbide drilling was shown by Schweizerische Industrie-Gesellschaft. Work rotates and drills remain stationary. Oil is pumped at 70 atm. Feeds of 5 to 6 ipm are obtainable with good tool life.

New approach to the problem of rolling splines with cylindrical rolls was demonstrated by Pee-Wee. Rolls are tapered to provide a throat, and work, held between centers, is forced between the rolls by a hydraulic cylinder. The same company also showed the manufacture of rolled studs from the coil at 150 per min, including straightening, cutting off, and threading both ends. Fortuna-Werke displayed an automatic cylindrical grinder with automatic loader and sizing device.

Government Writes Finis to Aluminum Aid

WASHINGTON — There'll be no more government assistance for new primary aluminum plants. The Office of Defense Mobilization has closed the 1.74-million-ton expansion goal for aluminum ingot, disclosing that 1.77-million tons of capacity are already in sight under present industry plans.

ODM's decision against new aluminum expansion came after four companies — Revere Copper & Brass, Reynolds Metals, St Joseph Lead-Pittsburgh Consolidated Coal Co, and Kaiser Aluminum & Chemical —had applied for fast tax writeoffs on new plants.

Except for St Joseph, which has not announced its plans, the companies say they are going to build a total of 285,000 tons of new primary aluminum capacity without government accelerated tax amortization assistance.

In addition, Alcoa has plans to expand its capacity. Olin-Mathieson was previously granted a fast tax writeoff on a proposed 60,000-ton plant in West Virginia, but the company held back until the market guarantee contract could be negotiated. But now that such government deals will no longer be made, it's not known whether O-M will go ahead.

Prior to closing the expansion goal, ODM gave the green light to Harvey Machine Co to put up a 54,000-ton primary aluminum plant in The Dalles, Ore. Harvey already had a fast tax writeoff, and ODM finally approved a market guarantee arrangement — a deal that had been hung up for some time over federal electric power policies.

Production Workers Pound Pavements

A salesman's got it easy?
Think so? Says Salesman H L Staubach to John Hannan, calculator assembler, "come out with me for a day and we'll see about that."

Okay, shop man, let's try it for a day . . .
Milling machine operator Frank Rofinsky (right) got an invitation to be a salesman-for-a-day, too. Here he watches assistant branch manager H L Woodruff show Miss Olga La Salvia of Boston Insurance Co's Newark, N J, office how her work could be simplified with a Monroe calculator

ORANGE, N J—"A fast-talking guy in fancy clothes who's vastly overpaid for peddling a product that's so good it would sell itself anyway" is a pretty fair way to sum up the shop man's view of his firm's salesman. But there are three production workers at Monroe Calculating Company's plant here who don't share that opinion any more, if they ever did. They're a screw machine operator, a milling machine operator, and a calculator assembler who were recently invited by the sales staff to come along for a day and see what it takes to sell calculators. The salesman-for-a-day idea is part of the company's industrial relations program, designed to give employees an idea of what their fellow Monroeites in other departments do for a living.

The shop men's reaction after a day of pavement pounding? Here are

Automation Conference Opens in New York

NEW YORK—New ideas and concepts in automation, plus a review of its basic principles, will highlight American Management Association's three-day Special Manufacturing Conference on Automation at the Hotel Roosevelt October 10-12.

Of particular interest to Metalworking management are three talks on October 10: "Machine Tools and Automation," by David N Smith of Jones & Lamson Machine Co, and Paul Maker of Bryant Chucking Grinder Co; "Selecting Automatic Controls for the Job Shop," by Wallace E Brainard, Hughes Aircraft Co; and "New Perspectives in Machine Design," by Charles F Hautau of Hautau Engineering Co, Detroit.

Second day's program will lead off with "Case Studies in Automation," detailed by Howard Gleason of Stromberg-Carlson Co, B M Middlebrooks of Minute Maid Corp, and J W Kuebler of Dixie Cup Co.

Management-Automation Panel

Afternoon will be given over to a panel discussion of such aspects of automation as how do you take the first step? Who makes the decisions? What changes in plant layout are involved?

Concluding day, October 12, will be given over to "New Horizons of Automation," with talks covering "Centralized Control and the Factory of the Future," "Worker Welfare in the Era of Automation," and a concluding luncheon address by Lt Gen Leslie R Groves, WWII head of the Manhattan Project and now vice president Remington-Rand Division, Sperry-Rand Corp, on "What Automation Means to Top Management."

As "Salesmen for a Day"

You gotta make calls . . . and they're not always so successful. H L Woodruff tells Frank Rofinsky he's had to pull out an on-trial machine and it's "no sale" here

if you wanta get results . . . is the old sales motto. And this time it's successful. Here Assembler John Hannan (third from left) looks on as Salesman H L Staubach (right) delivers a calculator to Vice President Albert Schnitzer, Schnitzer Alloy Products Co, Elizabeth, N J

a few: "a salesman has to expend a lot more effort than we do to get returns," "prospects have 101 reasons why they shouldn't buy," "the salesman can't walk away from his job when the bell rings at 4:30—must spend evenings working out a figure application for a customer, or writing up a proposal for an installation," and "a salesman's got to be able to take it." The shop men's consensus: "Every man does the job he's qualified for, and the Monroe salesman has to be good to keep us in business." The salesmen, too, felt they had learned a lot from the shop men's reactions as they saw their products' end use in customers' and prospects' offices.

Most interesting reaction of the shop men after a day as salesmen: "Would we swap jobs? No thanks, we'll stick to our machines if you don't mind."

WHAT'S THE DEFENSE BUYING OUTLOOK?

From Here on Out, Hard Goods Pursestrings Are Tightening

Metalworking's best customer — the U S government — will be a tougher outfit to deal with from now on. Today's "Era of Good Feeling" in world politics is taking the pressure off the armament race and putting it on the Pentagon to save money by cutting military hard goods spending to the bone

WASHINGTON — The federal government has been the largest customer of the metalworking industries for the last four or five years. Up to now, the outlook has been that military buying of planes, guns, ammo, and the like would stay about at the present level of $12.7-billion a year.

Now, however, the outlook has changed: domestic and world politics make it clear that from here on, the pressure is on Pentagon officials to spend less and less for military hard goods.

Two Prime Reasons

It's all tied in with two things: (1) the administration's drive to come up with a balanced budget by next June 30, and (2) the fact that world tensions have eased so markedly that it's very difficult for the administration not to bring its military spending down.

With the outlook so clearly geared to peace, administration officials face tremendous temptations to make their life easier by cutting back on military orders.

The Defense Dept's fiscal 1956 budget, submitted to Congress last January, showed this year's spending total as $35.7 billion. But the military said that checks would be written only for $34 billion, that $1.7 billion would be saved in anticipated slippages in production—and related factors — which would inevitably slow down the volume of spending.

So far, $1 billion of this $1.7 billion saving is still unidentified; actually, military expenditures are running above the initial estimate. Pentagon budget experts say they are straining to come down to the the $34-billion figure, and that what savings will be made "will come mainly outside procurement."

But the outlook for military expenditures is becoming clearer: from here on out, there'll be a clamp-down on hardware procurement wherever possible. Defense Secretary Charles E Wilson and his fiscal officials have spelled out how new savings will be made:

- Every Defense Dept program is getting a tougher screening. Marginal projects won't be started.
- Projects that are in for $100 million this year will be given the squeeze to see if they can't be done for $90 million.
- If the department has gotten delivery on 80% of the items called for in a contract, the program will be rephased — officials will be urged to slow down deliveries of the balance so that some of the spending won't show up until after the fiscal year is over.

This works particularly in a situation where a new plane, for instance, is just coming into production. You step up orders for it (added spending won't show up quickly), drop orders for the older plane where spending can be sweated down some. For example: last fall the Navy made substantial cancellations in aircraft contracts which are only now showing up as cuts in spending totals.

The rephasing method also helps along another Pentagon policy: the maintenance of the mobilization base, keeping production at multiple sources going at low rates.

$2 Billion Cut in '57?

Looking beyond fiscal 1956, Pentagon budget officials say that the $34-billion spending level could be cut by as much as $2 billion.

The Pentagon is grimly seeking ways to slash military spending, that will stand up to Democratic charges that military strength is being weakened. One plan now being studied: development projects about to be pushed into the costly prototype design and test stage—specifically, weapons duplicated by other R & D projects. Example: the Navy has just developed a highly automatic, rapid-fire three-inch gun at a cost of over $50-million. At the same time, it developed and put into service the "Terrier," a guided missile that outperforms the new gun.

If the new plan is enforced, this sort of thing won't happen again. There'll be a new emphasis to reduce the variety and number of weapons under development and to stop buying weapons with short service lives.

"Millions Down the Drain"

One top-level Pentagon official says "hundreds of millions of dollars" go down the drain on such projects, that too much is being spent to improve current weapons about to become obsolete—like conventional ack-ack guns.

A related plan under study at the Pentagon: to standardize arms buying. For instance, the Air Force and Navy now buy eight different types of 20-mm aircraft cannon and two types of 20-mm ammunition. There's already been some success along these lines. The two services recently got together on the same small-diameter rocket. Before, they were buying models with different propellants, fin assemblies, and explosive heads—even though performance of both was the same.

"Politically Explosive"

The military budget has become one of the most politically-explosive issues now simmering between the Republicans and Democrats. Some Democratic Congressmen claim they are wrapping up a package of evidence to show that deliveries of planes and other weapons are being deliberately delayed to bring spending down and to produce a balanced budget for the voters in November 1956.

Note the recent report of the Senate Preparedness Subcommittee, headed by Senator Lyndon Johnson, the majority leader. The group started to investigate profits of military aircraft contractors. It's now

branching into a general probe of U S airpower as compared to the Russians'.

On aircraft earnings, the subcommittee made only a general warning against "excessive or unjustified profits," but offered no proposals for new profit curbs. Instead, the subcommittee's emphasis was on the need to investigate details on U S air strength. Behind this, of course, is the aim of showing up how budget cuts are hurting military preparedness.

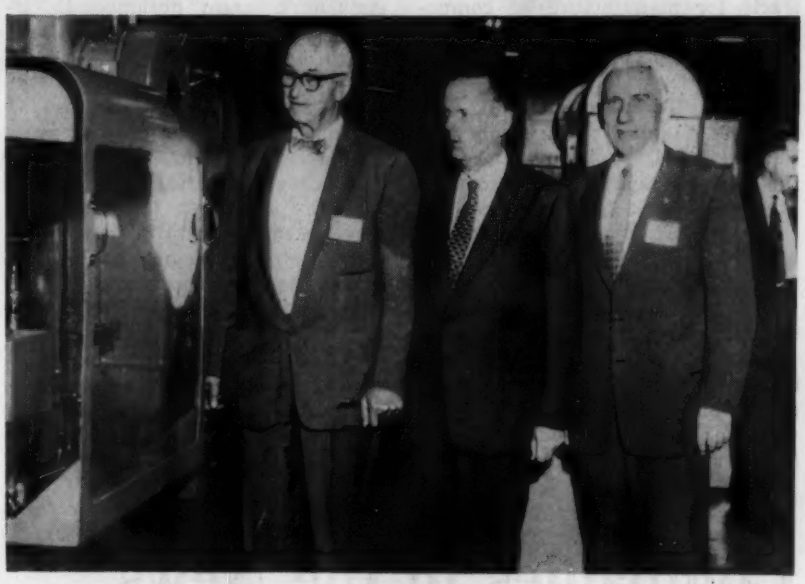
Some Republican administration leaders, however, are not taking Humphrey's policy proposals sitting down. Air Force Secretary Donald A Quarles, for instance, warns that there would be "great difficulty" in balancing the budget without injuring the military program.

Industrial Disaster Groups To Discuss Flood Meaures At All-Day Forum

SPRINGFIELD, MASS—To help Industry guard against future disasters such as resulted from the hurricane-floods in New England and the South, the Industrial Security Institute and the Civil Defense Research Associates, Inc, will hold an all-day Disaster Forum, or seminar, here. Scheduled for November 9, the morning and afternoon sessions will be devoted to the problems of industry and the evening session will cover the overall civil defense aspects. These meetings will be open to all industrial personnel directly concerned with disaster control, safety, plant defense, and security. The seminar is probably one of the few opportunities to analyze in detail the flood effects with the people who saw them first hand. For information, write: S A Anthony, President, Industrial Security Institute, 475 Fifth Ave, New York 17.

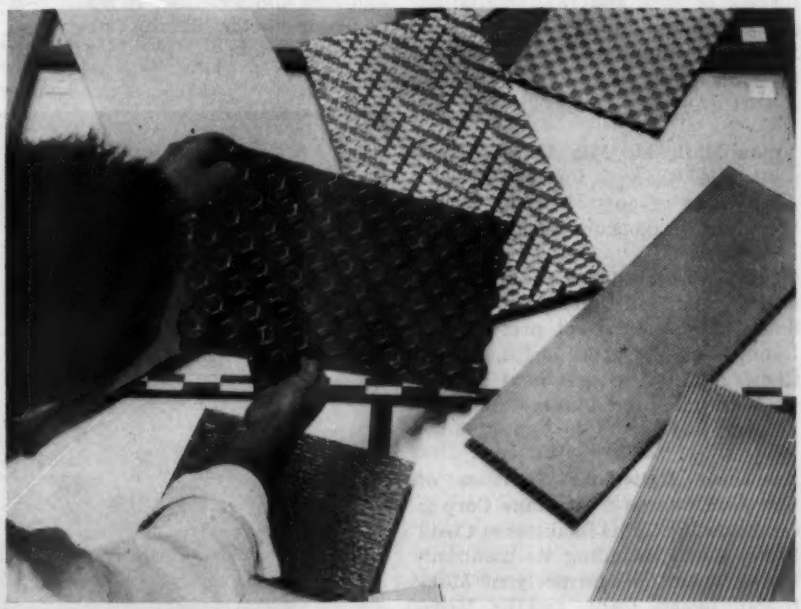
New Departure to Hold Bearing Conference

HARTFORD, CONN—GM's New Departure Division will be host to top engineering and management people from the electric motor industry at a two-day Electric Motor Ball Bearing Conference at the Statler Hotel here November 2-3. Program will include panel discussions and a tour of New Departure's manufacturing and engineering facilities.



Governors Tour Machine Tool Show

CHIEF EXECUTIVES OF ILLINOIS AND VERMONT, Governors William G Stratton of Illinois (center) and Joseph B Johnson of Vermont (right) are welcomed to the Machine Tool Show by President Henry P Chaplin of Vermont's Cone Automatic Machine Co Inc (left). Governor Johnson, who came to the show as guest of Cone and the show's three other Vermont exhibitors — Bryant Chucking Grinder Co, Fellows Gear Shaper Co, and Jones & Lamson Macnine Co — was for many years vice president and general manager of Bryant Chucking Grinder Co



Now It's Textured, Colored Stainless

A PRINCETON UNIVERSITY RESEARCH PROJECT has come up with textured and colored stainless steel in pattern depths from 1/200 to 1½ in. The one-directional and all-over patterns come in either geometrical or irregular design, have widths of ⅛ to 8 in. Sheets are up to 36 in. wide, can be colored partially or all over by Princeton-developed glazes. Deeper, all-over patterned sheets must be flattened for joining; vertically placed, one-directional patterns can be made to interlock. The Princeton project report recommends the sheets for faster, more economical construction of office buildings, apartment houses

North American Aviation announces it awarded $172 million in subcontracts for manufacture of components for its jet planes during the first half of the year.

Republic Gear Co, Detroit, has licensed **Maquinas York Co** of Sao Paulo, Brazil, to manufacture its full list of automotive products. **Maquinas York** has also been licensed to make all products of **Detroit Bevel Gear Co** and the Rzeppa Universal Joint, a product of Republic Gear's parent company, **Gear Grinding Machine Co.**

Perfection Spring Mfg Co has opened a new plant at 3354 N Pulaski Rd, Chicago, to make wide and flat forms, springs and stampings.

Beryllium Corp, Reading, Pa, has launched a two-year, $2-million expansion program designed to increase its output of beryllium and beryllium alloys by 60%.

A O Smith Corp has under way a $4.4-million expansion program at its Kankakee, Ill, works, which will increase manufacturing and storage space by 270,000 sq ft. A O Smith makes domestic and commercial water heaters, and home heating and airconditioning equipment at Kankakee.

Veeder-Root Inc, computer manufacturer, will build a $1.5-million gasoline pump computer and oil tank register manufacturing plant at Altoona, Pa.

Chrysler Corp will buy the plant, equipment and inventories of **Universal Products Co** and its subsidiary, **Formetal Co,** for an anticipated price of $3 million. Universal makes automotive drive shafts and components at Dearborn, Mich. Formetal makes stampings and forgings at Ecorse, Mich.

Allis-Chalmers Mfg Co has shipped its first distribution transformers from its new Gadsen, Ala, transformer manufacturing plant.

Pheoll Mfg Co, Chicago, has purchased **Voi-Shan Mfg Co,** Culver City, Calif, maker of fasteners and bolts for aircraft.

Studebaker - Packard Corp is regrouping its manufacturing operations by (1) consolidating all its Packard and Clipper operations into a **Packard-Clipper Division,** and (2) Studebaker car and truck operations into a **Studebaker Division,** with each division a separate entity reporting to S-P President James J Nance.

General Electric Co plans to spend upwards of $1 million in expanding its New England facilities—$500,000 to convert a Bridgeport, Conn, warehouse to fan manufacture, and $600,000 to increase insulated wire output at Pittsfield, Mass.

Companies in the News . . .

United States Steel Corp's Homestead (Pa) Works is expanding its Forgings Division by (1) installation of gas-fired vertical heat treating furnaces and an adjoining quenching tower, (2) relocating and altering forging presses, and (3) installation of new heavy-duty machine tools such as turning and boring lathes, planer millers and vertical boring mills.

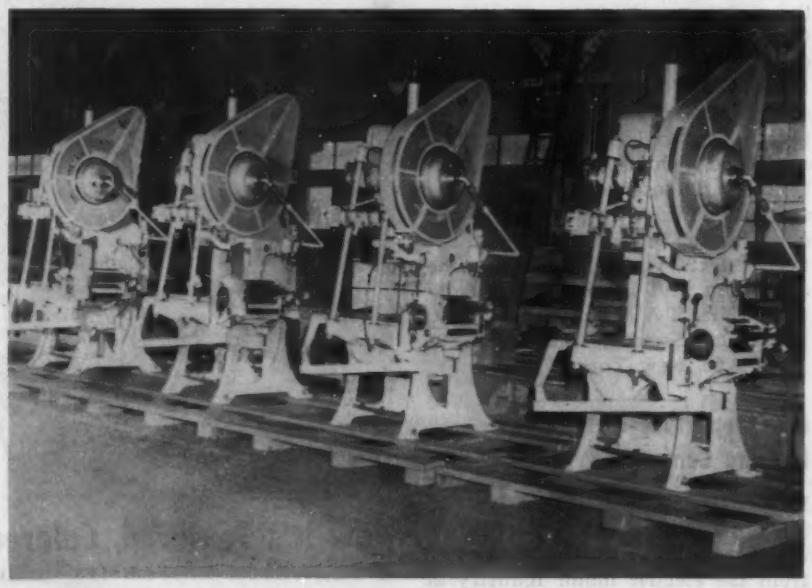
Union Malleable Mfg Co has completed a 47,000-sq-ft foundry at Ashland, Ohio, as part of a long-range $8-million expansion program.

General Electric Co will build a $5-million plant at Lynchburg, Va, to house its Rectifier Dept, presently at Lynn, Mass, and at Limerick, Maine. Construction will start next March, with initial production slated for January 1957.

American Helicopter Division of **Fairchild Engine & Airplane Corp** is consolidating all its facilities at Costa Mesa, Calif, including its manufacturing operations formerly at Manhattan Beach, Calif, and its Mesa, Ariz, testing facilities.

Fafnir Bearing Co is building a $1.5-million, 160,000-sq-ft, one-story machining and heat treating plant on a 100-acre site at Newington, Conn, bringing Fafnir's manufacturing space in the New Britain-Newington area to a total of 1.1-million sq ft.

Blaw-Knox Co, Pittsburgh, is dickering for purchase of **Continental Foundry & Machine Co.** Estimated price: $25 million. Blaw-Knox wants Continental's plants at Erie and Coraopolis, Ohio, Wheeling, W Va, and East Chicago, Ind, to make B-K a major factor in the steel mill equipment field.



First All-West-Coast-Made Presses

FOUR NEW 20-C BLISS INCLINABLES, made at E W Bliss Co's San Jose, Calif, plant, with frames cast by General Metals Foundry, Oakland, Calif, these are the first presses to be completely manufactured on the West Coast. They'll be used on the West Coast, too, by Foil Kraft Co, Los Angeles

Carl Roby, a vice president and director of Cincinnati Milling Machine Co, has been named president of the recently acquired Heald Machine Co, Worcester, Mass

Orrin W Barker, chief engineer of Kearney & Trecker Corp, has been elected vice president in charge of engineering

James C Mabe, Jr, formerly associated with Douglas Aircraft Co, has been appointed manager of plant operations for Chicago Pneumatic Tool Co

Names in the News . . .

Union Twist Drill Co appointments . . **George F Holland,** president, to chairman of the board; **Stanley Holland,** general manager of the Butterfield Div, to president; **John C Molinar** to vice president, sales; **Rossiter Holt** to vice president and general manager of the S W Card Plant; **John Engelsted** to vice president in charge of production of the Union Twist Drill Plant.

C L Peterson, divisional vice president of Brown Instruments Division of Minneapolis-Honeywell Regulator Co, has been appointed vice president and general manager.

C E Hartsing, Western sales manager for Toledo Pipe Threading Machine Co, has been named manager of field sales.

Beaver Tool & Engineering Corp, Royal Oak, Mich, appoints . . **Delmar Landen,** vice president, sales; **Wilbur Weise,** assistant vice president, sales; and **Clement Ratke,** vice president, engineering.

George Baillie, Jr, acting sales manager since January of E W Bliss Co's Rolling Mill Div, Salem, Ohio, has been appointed sales manager. **Jack E Garnhart,** Wisconsin area manager, has been appointed district sales manager at Chicago.

Roy C Heacock, formerly vice president and director of engineering and manufacturing for Barber-Green Co, Aurora, Ill, has been appointed engineering director of Axelson Manufacturing Co, Division of US Industries, Los Angeles.

Baldwin-Lima-Hamilton elections . . **Robert B Murray, Jr,** former Undersecretary of Commerce, named a vice president and board member; he has currently been serving as assistant to the B-L-H president; **James M White,** formerly vice president, manufacturing, at ACF Industries, elected to a similar post at B-L-H; **Col John R Martin** (Ret), named vice president in charge of electronics and instrumentation operations.

J O Ellison, president of the Harron, Rickard & McCone Co of Northern California, San Francisco, has been named new secretary-treasurer of the American Machine Tool Distributors' Association.

William E Fowler, general traffic manager of Youngstown Sheet & Tube Co, and **Herman J Spoerer,** director of industrial relations, have been elected vice presidents of the company.

Jerome F Ferdinand, formerly vice president, sales, of Wales-Strippit Corp, has been named sales manager of Punch Products Corp, Niagara Falls, NY

Harold A Daschner, new managing director of the Pressed Metal Institute (*AM*, Sept 26, p193)

OBITUARIES

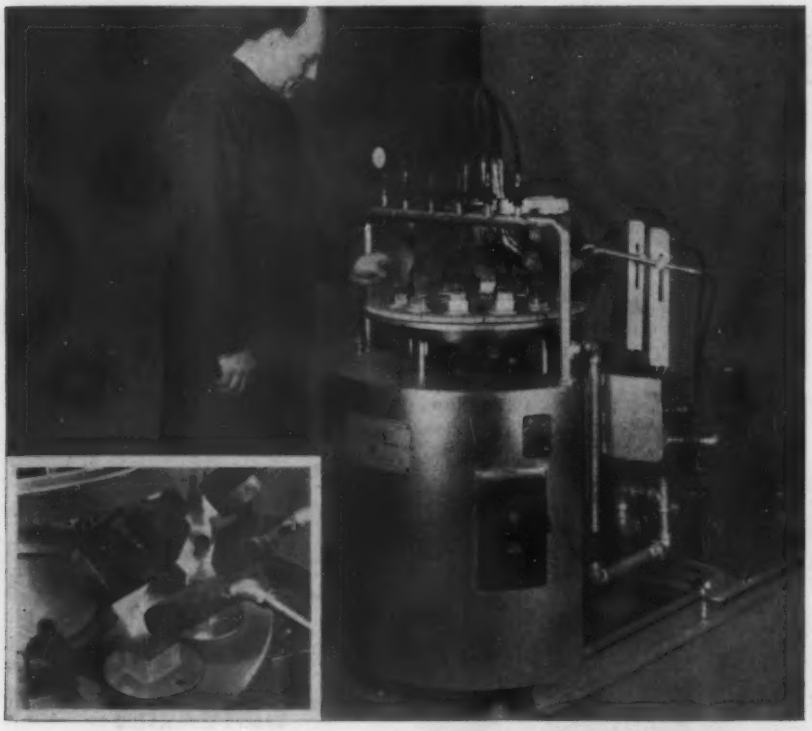
Adolph Machlet, 90, board chairman of American Gas Furnace Co, Elizabeth, NJ, and president of its subsidiary, American Metal Treatment Co, died Sept 27. An inventor of some 60 processes in the metallurgical field, Mr Machlet was particularly well known for his developments in case-hardening, including gas carburizing, Ni-Carbing, and suitable furnaces.

William Fisher Jennings, president and treasurer of Bound Brook Oilless Bearing Co, Bound Brook, NJ, died Sept 14. Mr Jennings was one of the pioneers in the field of metal powder manufacturing.

Metal show in print...

Products shown in this section have not been described previously in our pages. All will be exhibited, along with others previously described, at the Philadelphia Metal Show, Convention Hall, October 17 to 21, 1955

Gas-Fired Brazing Unit Handles to 500 Parts per Hour



Automatic brazing of small and medium-sized assemblies is provided by this packaged brazing unit. Production rates are said to be as high as 500 parts per hr, using one unskilled operator.

Equipment is mounted in integral structural steel frame. Included are combustion controller, to deliver fuel/air mixture at predetermined rate; adjustable burners; permanent or replaceable fixtures; dial-type work table to carry work past burners in continuous or intermittent motion; and pneumatic indexing equipment, timers, and electric motors. Provision may be made for specialized functions such as automatic feed and delivery or water-controlled cooling.

Each machine is engineered to meet a range of work specified by the user. The machine shown is brazing burner assemblies. Fixtures for assemblies are easily replaced, by lifting out the old one and replacing the new fixture on guide pins.

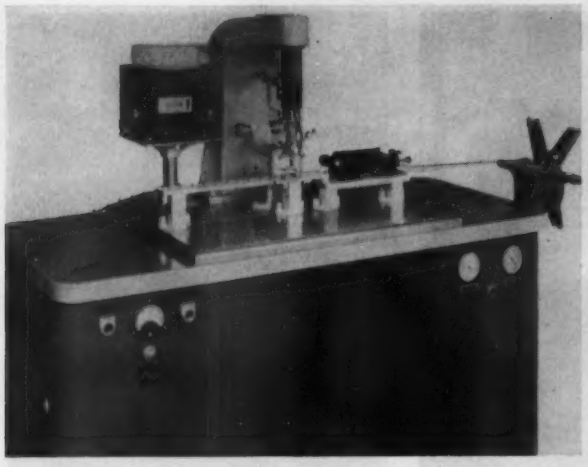
Selas Corp of America, Erie Ave & D St, Philadelphia 34, Penna

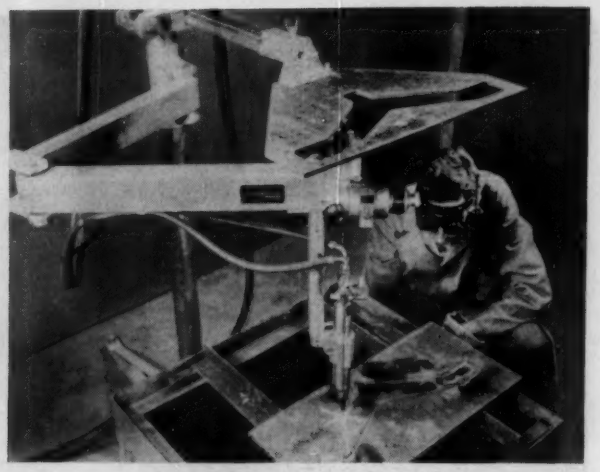
Elox Fixture Has Electronic Positioning

Elox electrical-discharge tool-grinding fixture has electronic controls which position the tool to be ground to a predetermined pattern. No templets are required. On single-point tools, the carbide, steel shank, and silver solder can be machined simultaneously, without damage to the tool, because the grinding wheel does not touch the work.

The process is said to give up to 5 times increased tool life, and as much as twice as many regrinds per tool. No diamonds are used.

Elox Corp of Michigan, 740 N Rochester Rd, Clawson, Mich





Automatic Stud-Welding Machine

Model X-8000 is an automatic stud welder which uses the Graham process of stored energy stud welding. Stud feed to the gun is automatic, and strip stock is fed to the machine from a continuous coil. Studs can be welded at about 80 per minute, while power consumption averages 1½ kva. Unit can be furnished with revolving index table to permit stud welding of various individual parts or assemblies. Pedal is supplied to permit single-stroke operation, while automatic stud feed is also possible.

Graham Manufacturing Corp, 31465 Stephenson Highway, Royal Oak 4, Mich

Wieland Metal-Worker Develops 25-ton Hand-Applied Pressure

Hand tool develops 25-ton working pressure when 150-lb force is applied, to do a number of jobs. Tool is essentially a hand press, for bending, bar shearing, angle-shearing, and punching.

Rated capacities are: bending, 2 x 3/16 in.; shearing flat work, 2 x 3/16 in.; shearing angle bars, 1½ x 1½ x ⅛ in.; and punching, ⅛ to ½-in. diameter.

Various punch and die designs are available.

Diesel Power Inc, Box 72, Greenville, Penna

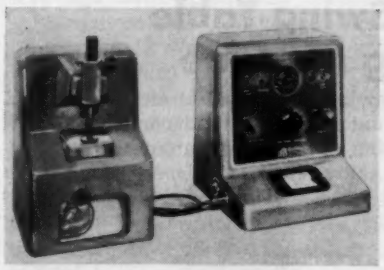
SaberSaw Attachment For Drills

SaberSaw hacksaw attachment for air- or electric-powered hand drills is designed for drilling wood, metal, plastics, and other materials. Attachment weighs 3 lb 3 oz, is 7¼ in. long, and 2⅝ in. in diameter at widest point.

Device has no gears, but operates with all ball-bearing reciprocator. Blades may be changed by removing 2 setscrews. Rifle-sight pointer and steadyrest rocker aid accurate cutting. Said to fit any drill of ¼-in. or larger capacity.

Special blades for keyhole, scroll, and hack sawing are available. Price, $45.

Thor Power Tool Co, Aurora, Ill



Model 1715AB Electro-Polisher Has Separate Power Supply

Model 1715AB is made up of two separate units, the power pack and polishing cell. Power pack has self-contained rectifier with output of 5 amp dc, with positive variable output control in both low and high ranges.

Automatic pre-setting timer, 0 to 60 sec, provides cycle time. Variable transformer in power pack controls speed of pump motor in the polishing cell, and offers variable 0-100-volt ac control through separate extension receptacle.

Three washer orifices are available — 5/16, ½, and ⅝ in. in diameter.

Beuhler Ltd, 2120 Greenwood St, Evanston, Ill

Houghto-Clean 402 and 403 still-tank, room-temperature cleaning compounds are said to require no heating or special equipment, replacing solvent-type cleaners.

E F Houghton & Co, 303 W Lehigh Ave, Philadelphia 33, Penna

Camograph No. 42 Flame Cutting Machine Has Magnetic Roller

No. 42 Camograph features permanent magnetic roller, and will cut shapes to 42-in. circle, or straight lines to 92 in. Machine can be used as either a production tool for repetitive cutting with a single torch, or as an auxiliary unit to supplement output of larger machines.

Permanently magnetized tracing roller follows metal templet. Motor drive shaft is equipped with worm-gear drive, with no couplings, pulleys, or belts. Machine is portable.

Air Reduction Sales Co, Div of Air Reduction Co, Inc, New York 17, NY

Ivy Dynamic Creep Tester

Model BJL-1 dynamic creep testing machine consists of basic unit and its controls, grips, furnace and controls, and recording equipment. Either standard or special grips can be supplied, and furnace controls and recording equipment are supplied to customer's specifications.

Adjustable bumper with an amplitude switch permits adjustment so machine will stop before complete fracture, to allow examination of the fatigue-creep fracture. Creep provided for is ⅜ in. PIC Controller is said to maintain constant static force on specimen during test.

The Ivy Company, 15 Merwin St, Norwalk, Conn

B&L Metallurgical Microscope

Bausch and Lomb dynoptic metallurgical microscope has ball-bearing focusing mechanicam and revolving nosepiece. Low position fine focusing and below-stage mechanical stage controls are said to permit easy use. Can be used with either vertical illuminator or Tri-Vert illuminator.

Bausch & Lomb Optical Co, Rochester 2, NY

Wheelabrator 96-in. Swing-Table Airless Blast Cleaning Machine

Machine is designed for cleaning or descaling forgings, castings, heat-treated work, weldments or stamping, and similar work. Work table swings into room to aid loading and unloading with crane or truck. Blasting operation is automatic.

Wheelabrator Corp, Mishawaka, Ind

Portable Crane Eases X-ray Work

Portable crane is designed to serve either as a stationary mounting or a mobile base for on-location X-ray inspection. Handles heads of 160 kv, 180 kv, 200 kv, and 260 kv units.

Crane permits operator to raise and lower head to maximum height of 87 in., and minimum height of 24 in., with extension boom available to widen range to 14 to 101 in. Head may also be rotated through 360° around either vertical or horizontal axes.

Balteau Electric Corp, New & Meadow Streets, Stamford, Conn

Autocarb Controller Regulates Dewpoint, Carbon Potential

Autocarb is an automatic carbon potential control instrument for controlled-atmosphere heat treatment. By controlling the dewpoint, carbon potential of the furnace atmosphere is also regulated.

Device is said to be applicable for processes such as gas carburizing and clean hardening, where a permanent record is not required.

Surface Combustion Corp, Toledo 1, Ohio

Angle Vise Has Swivel Base

Rapid, accurate setups at any angle can reportedly be made on the Palmgren No. 23B without use of clamps or wedges.

Unit has 3-in. jaw width and opening, and 1¾-in. jaw depth. Can be used with or without the 360° graduated swivel base, and can be set at any angle from zero to 90° in a vertical plane. It can also be used as an ordinary machine vise in the horizontal position. Device is accurately graduated and ready for use by locking the adjustment support screws.

Chicago Tool & Engineering Co, 8383 S Chicago Ave, Chicago 17, Ill

Raytheon Impact Grinder Has Added Power To Cutting Head

Series 2-332 of Raytheon impact grinder for ultrasonic machining has 700-watt power input to cutting head, 40% more than previous models, with claimed increase in cutting speed of 25%.

Typical rate cutting speed is 0.018-0.020 ipm in carbide when cutting with ½-in.-diameter tool using 180-grit abrasive. Maximum practical grinding area is 1.75 sq in. in metals, and 3 sq in. in non-metals.

New tool-cone suspension system is said to maintain a constant force at the work from 1 oz to 16 lb, in 1-oz increments. Machine is said to be able to drill holes as small as 0.002 in.

Machine is available with single or dual abrasive slurry. Dual slurry permits interchangeable use of roughing and finishing grits. Grits range from 50 to 320 for roughing and 600 to 1200 for finishing. (This supplements information in *AM*—Aug 29, '55, p716.)

Raytheon Manufacturing Co, 100 River St, Waltham, Mass

Multi-Range Fatigue Tester

Ivy-12 multi-range fatigue-testing machine offers either high-force—12,000 lb, or high amplitude—±¾ in., testing. With constant dynamic force principle of operation, inertia force compensation is said to automatically maintain dynamic force, regardless of change in elastic properties of test piece.

Electric control is designed to maintain constant static force, regardless of elongation of test piece. Direct-reading scales permit setting of static and dynamic forces without conversion factors.

All electrical cables and wiring are in built-in steel ducts and flexible conduits.

At high-load station, max total force (tension or compression) is 12,000 lb, with ±6,000 lb max alternating force, at 1200 cpm. Max amplitude is ±⅜ in., with 160-lb complementary weight.

At high-amplitude station, max total force is 6,000 lb, with ±3000 lb max alternating force. Max amplitude of vibration is ±¾ in., at 1200 cpm, with 40-lb complementary weight.

The Ivy Company, 15 Merwin St, Norwalk, Conn

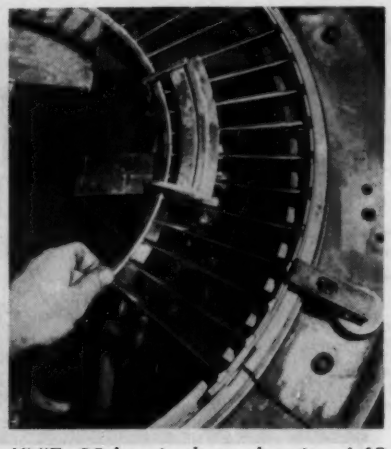
Welding Positioner Has 1000-lb Capacity

P&H model UP-1000 welding positioner has capacity of 1000 lb, permits free rotation of work to any position within horizontal, vertical, or intermediate planes. Said to keep workpiece in static balance even when arm is adjusted up or down to horizontal.

P&H Harnischfeger Corp, 4400 W National Ave, Milwaukee 46, Wis

B & L Focusable Serial Image Viewer for Model N eyepiece camera is said to permit focusing sharply for photographing specimens of low contrast and detail. Eyepiece permits setting for individual viewers.

Bausch & Lomb Optical Co, Rochester 2, NY



ALLIS-CHALMERS INDUCTION HEATING UNIT, 25 kw, is shown brazing J-65 jet engine compressor blades into the compressor ring. Photo at right shows close-up of fixture and work coil. Heat output is rated at 1400 BTU per minute. Power factor is 90%—*Allis-Chalmers Manufacturing Co, Box 512, Milwaukee 1, Wis*

Automatic Heat Treating Setup

Continuous automatic heat treatment of various sizes of workpieces is done with an installation made up of an automatic feeder, a controlled-atmosphere reciprocating furnace and automatic quenching tank.

Equipment will discharge work into automatic washing machine and tempering furnace of neighboring exhibit at show (Metalwash Machinery Co, Elizabeth, NJ).

Capacities of this equipment are from 100 to 800 lb per hr. Installation can be made either in-line or reversing-loop, which permits work to be discharged adjacent to charging end of furnace.

American Gas Furnace Co, Elizabeth B, NJ

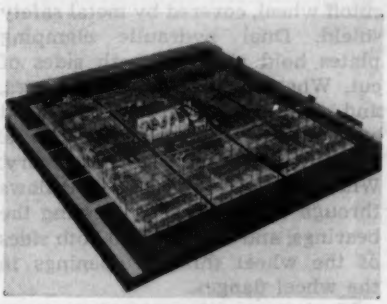
Airco 800-amp TCV Welder For Inert-Gas Shielded Welds

Model TCV rectifier arcwelder is designed for inert-gas shielded consumable electrode welding, is said to feature constant arc voltage for automatic machine welding applications employing constant-speed wire feed.

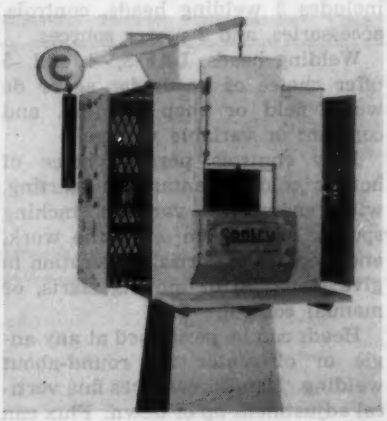
Welder contains 3-phase transformer and rectifier bank, with aluminum-wound coils, silicone and glass insulated. Forced draft cooling is provided by fan with reversible ball-bearing motor.

Arc voltage may be pre-set from 15 to 44 arc volts, and may be pre-set to provide higher initial voltage for easier starts. Once the arc is established, the voltage drops to the pre-set value.

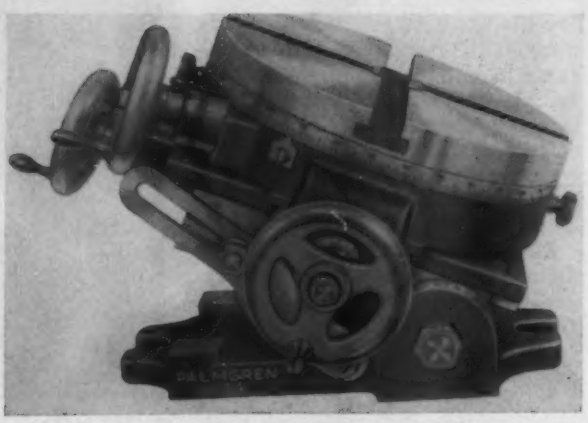
Air Reduction Sales Co, Div of Air Reduction Co, Inc, 60 E 42nd St, New York 17, NY



SCALE MODEL of 77,000-sq-ft plant producing steel kitchens, is built to scale of ¼ in. = 1 ft. Duplicates building components, production machines and equipment, work in process, materials handling, and other elements. This is one of a number of models of its type, which are used for sales and promotion work—*Knight Models, Inc, 549 W Randolph St, Chicago 6, Ill*



MODEL Y HIGH SPEED HARDENING FURNACE has new roller-bearing straight-line door mechanism, one-piece fabricated pedestal, and internal changes to improve heating and operating efficiency — *The Sentry Co, Foxboro, Mass*



Semi-Automatic Cutoff Machine Works Either Wet or Dry

Semi-automatic Bullard abrasive cutoff machine has entirely enclosed cutoff wheel, covered by metal safety shield. Dual hydraulic clamping plates hold work on both sides of cut. Wheel travel, clamping plates, and wheel cover are all operated by double-acting hydraulic cylinders.

Machine may be used wet or dry. When cutting wet, the coolant flows through the wheel shaft, cooling the bearings, and is applied to both sides of the wheel through openings in the wheel flanges.

Maximum surface speed is 13,500 sfpm. Rated capacity in solid work is 2½-in. diameter; in squares, to 1¾ in.; angles, 4 in.; and tubing, 4-in. OD.

Lombard Governor Corp, Ashland, Mass

Lincoln Automatic Welder

Equipment is designed for submerged or hidden arc welding. Line includes 3 welding heads, controls, accessories, and 2 power sources.

Welding heads, LAF-3, -4, and -5 offer choice of heads for ac or dc work, field or shop welding, and constant or variable voltage.

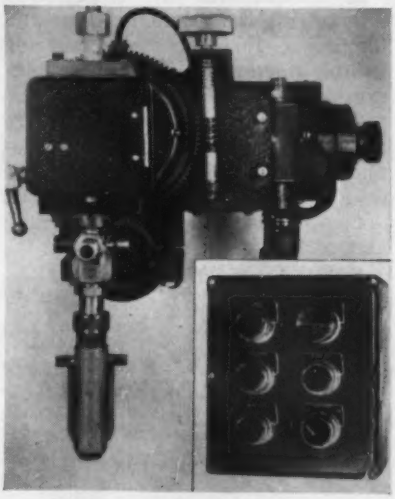
New controls permit choice of hot or cold instantaneous starting, with choice of variable inching speeds, away from or to the work, and a choice of carriage operation to give standstill or moving starts, or manual control.

Heads can be positioned at any angle or off-center for round-about welding. Handscrew gives fine vertical adjustment up or down. Flux can be placed with either welding jaws or welding nozzle, started and stopped automatically or manually.

Electrodes in sizes from 3/32 to 7/32 in. are handled by one set of drive rolls, while separate set of interchangeable rolls handles 5/64-in. wire. Roller-bearing wire straightener with single adjusting screw can be swung 360° about vertical axis to accommodate wire reels in any position.

In addition to heads, mounting equipment is available to give either stationary, self-propelled carriage, or self-propelled tractor mountings.

The Lincoln Electric Co, 22801 St Clair Ave, Cleveland 17, Ohio



Single-Motor Drive For Aircomatic Welding Head

Aircomatic welding head is designed for automatic welding wih the Aircomatic consumable-electrode process. It is said that argon, CO_2, and helium shielding gases and all kinds of welding wires (steel, aluminum, bronze, stainless, and Strandalloy) from 0.030-in. diameter up, can be used.

Head has single motor drive, simplified controls, and continuous current rating of 600 amps.

Air Reduction Sales Co, Div of Air Reduction Co, Inc, 60 E 42nd St, New York 17, NY

Rotary Index Milling Table Calibrated in 3-min Intervals

Tilting rotary index milling table, Palmgren No. 84 incorporates rotary feed and two cross-slides in addition to tilting feature enabling operator to set it at any angle from zero to 90° in a vertical plane.

Table has an 8-in.dia top, graduated 360°; center of top plate is bored for a 1½-in. locating plug; two locking screws secure top in position.

Rotary indexing dial is calibrated in 3-min intervals; crossfeed dials are graduated in thousandths. Cross-slides travel 4¼ in. at right angles, and crossfeed screws are ½-in. Acme thread. Hand wheels are removable and an indexing attachment and plates can be added to the rotary feed shaft.

Chicago Tool & Engineering Co, 8383 S Chicago Ave, Chicago 17, Ill

B&L Macroscope is Available In 10x, 20x, and 40x

B&L macroscope has erecting, inclined eyepiece, and is designed for inspection of small parts for burrs, cracks, and surface characteristics. Magnification available in 10x, 20x, or 40x. Working distance is 3½ in. Can be furnished with tripod, with microscope stand, or for building into machinery or inspection devices.

Bausch & Lomb Optical Co, Rochester 2, NY

Palmgren No. 86 Rotary Table has 8-in.-dia top, ⅝ x 1⅛-in. T-slots crossing at center which is bored for 1½-in. locating plug. Unit is graduated 360°; rotary feed is positive through worm and gear with 40:1 ratio; indexing dial is calibrated in 3-min intervals.

Chicago Tool & Engineering Co, 8383 S Chicago Ave, Chicago 17, Ill

FYI

FOR YOUR INFORMATION

FREE Catalogs, Booklets, Charts, Calculators

FYI—these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

MACHINES AND ATTACHMENTS

1 BED-TYPE MILLING MACHINE—*Motch & Merryweather Machinery Co, Cleveland 13, Ohio.* 16-page bulletin 2200 contains illustrated information on Mill-M-Matic heavy-duty unit with automatic electrical control; 84 possible spindle speeds from 25 to 1230 rpm. Detailed specifications, standard and optional equipment listed.

2 FORGING HAMMERS—*C C Bradley & Son, Cortland, NY.* 18-page illustrated catalog 155 describes four types: cushioned and upright helve; upright strap; and compact. Specifications, applications, principles of hot and cold forging included.

3 SINGLE-SPINDLE AUTOMATIC SCREW MACHINE—*Gear Grinding Machine Co, Detroit 11, Mich.* 6-page illustrated folder describes Detroit Screwmatic 750, designed on "unit-construction" principle. Any of the ten separate units making up the machine (including base) may be replaced separately as new developments or improvements occur.

4 PRESSES—*Clearing Machine Corp, Chicago 38, Ill.* 36-page booklet 238 illustrates a variety of models and applications. General information relative to advantages and performance of press equipment, selection suggestions, specific features of Clearing units included.

5 SURFACE GRINDER — *Thompson Grinder Co, Springfield, Ohio.* 6-page catalog D55 illustrates construction details and design features of Type D, 6x18-in. unit. Specifications, standard and optional equipment listed.

6 AUTOMATIC CAM-DRIVEN DRILL UNITS—*Morris Machine Tool Co, Cincinnati 3, Ohio.* 12-page catalog 92 presents illustrated data on Cam-Matic units. Two models covered; three types of drive arrangements, and three possible mounting positions. Operational information and specific features included.

7 PRESS ROOM EQUIPMENT—*Durant Tool Supply Co, Water St, Providence, RI.* 19-page illustrated catalog including description of many new items, covers indexers, feeds, straighteners, choppers, reels, lever controls, machines, cradles, guards, vises.

8 ROTO-FLO MACHINES—*Michigan Tool Co, Detroit 12, Mich.* 8-page bulletin RF-55 illustrates and describes complete line of "chipless machining" units for cold-forming of toothed parts. Process described, specifications provided.

9 FLASH TRIMMERS—*Morton Manufacturing Co, Muskegon Heights, Mich.* 6-page bulletin 85 illustrates and describes line of high-production units for variety of applications.

10 KELLER POWER HACKSAWS—*Sales Service Machine Tool Co, Saint Paul 14, Minn.* 4-page illustrated bulletin 615 covers complete line with capacity ranges from 4x4 in. to 10½x9 in. Features described and specifications provided.

11 PUNCH PRESSES—*Kenco Manufacturing Co, Los Angeles 22, Calif.* 4-page folder contains illustrated information on units from 1½ to 15-ton capacity. Construction features detailed.

TOOLS AND ACCESSORIES

12 TOOLHOLDERS & CUTTERS—*Viking Tool Co, Shelton, Conn.* 44-page catalog covers extensive line of cutters, carbide and HSS; carbide single-point tools with mechanical chip breakers; sharpening fixtures and methods; carbide grade and selection charts. Products are illustrated, specifications provided.

13 WAX LUBRICANTS—*S C Johnson & Son, Racine, Wis.* "Drawing & Forming" booklet explains functions, lubricity, and advantages of wax in metal-forming operations, especially under extrtme pressures and high temps (200,000 psi, 450 F). Case histories illustrate scrap reduction and increase in die life.

14 TOOLHOLDERS—*Carboloy, Dept of General Electric Co, Detroit 32, Mich.* 8-page illustrated catalog GT-293 gives prices and specifications of units for throw-away carbide inserts. Seven styles covered, plus technical data on 52 sizes. Blank grades for use with above or other standard holders discussed.

15 ELECTRICAL TACHOMETERS—*Weston Electrical Instrument Corp, Newark 5, NJ.* Catalog D9A gives details on new bearingless tachometer generators, as well as data on all Weston AC and DC

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voltage and frequency-responsive tachometer systems. Dimensional diagrams and mounting information included.

HEAT TREATING AND WELDING

16 ELECTRIC FURNACES & OVENS —*Cooley Electric Manufacturing Corp, Indianapolis 7, Ind.* 21-page illustrated catalog A-2, with price sheet, contains dimensions, specifications, temps, control data on bench and floor-type general-purpose electric units; high-speed, recirculating, and industrial-box furnaces; and electric ovens. Includes data on new series of controlled-atmosphere toolroom furnaces for operation to 2000 F.

17 CERAMIC SUPPORT FOR BRAZING—*Technion Design & Manufacturing Co, New York 12, NY.* Engineering bulletin 102 describes "super-refractory" Sur-Braze, a castable ceramic for use in soldering and brazing. Material is said to eliminate costly all-metal fixtures, permit closer assembly tolerances, minimize fixture jamming.

18 STAKE WELDING MACHINES—*Morton Manufacturing Co, Muskegon Heights, Mich.* 6-page bulletin 44 contains illustrated descriptions of line of automatic submerged and inert-arc units. Capacities given, and special applications discussed.

19 ELECTRIC PROPORTIONAL CONTROLLERS—*Foxboro Co, Foxboro, Mass.* 4-page bulletin 4-11 describes line for control of dewpoint, pressure, temp, etc, in batch process, combustion atmosphere, and heat-treating furnace applications. Functions and design features, typical installation views included.

PLANT SERVICE EQUIPMENT

20 UNITIZED FLEXI-STEEL SHELVING—*Borroughs Mfg Co, Kalamazoo, Mich.* 32-page catalog describes construction and installation features, illustrates 24 of variety of units, presents detailed data on how to plan a shelving layout.

21 STAMPINGS FINISHING — *Wheelabrator Corp, Mishawaka, Ind.* Bulletin 117-D covers finishing of stamped metal parts by means of airless abrasive blasting process with Wheelabrator equipment. Four illustrated case histories give performance data.

22 RUBBER PRODUCTS—*Thermoid Co, Industrial Rubber Div, Trenton, NJ.* 8-page illustrated catalog provides specifications and descriptions of 68 different rubber hose types for wide variety of applications. Data given on 9 types of conveyor belts, 7 designs of flat power transmission belting, multiple and fractional hp V-belts, chute lining, rubber sheet packing and industrial friction materials.

23 ELECTRIC FORK TRUCKS—*Baker-Raulang Co, Cleveland 2, Ohio.* 6-page bulletin 1327D illustrates and describes battery-powered units of 1500, 2000, and 2500-lb capacities. Tabular data on dimensions, capacities, weights, speeds; design and construction details; special attachments available included.

24 RECTANGULAR SEPARATION MAGNETS—*Ohio Electric Mfg Co, Maple Heights, Cleveland, Ohio.* 4-page illustrated catalog 114 contains detailed information on Super Magnetomotive units. Includes performance data, design features, selection details in tabular form.

25 FANS—*American Blower Corp, Detroit 32, Mich.* 4-page bulletin 7214 presents illustrated information on Model B Ventura units for light-duty industrial exhaust installations, and Model E for heavy-duty applications. Discusses features of V-belt-driven models; performance data in tabular form for 8 sizes in both lines.

PARTS AND MATERIALS

26 V-BELT DRIVES — *Allis-Chalmers Manufacturing Co, Milwaukee, Wis.* 74-page Tex-Book 20P40 contains multicolor tables for quick selection of constant speed Texrope drives. Includes sections on design features, basic drive principles, sheaves, operational recommendations.

27 TITANIUM — *E I du Pont de Nemours & Co, Pigments Dept, Wilmington 98, Del.* 8-page illustrated Progress Report No. 2 covers fabrication methods; tabular data on mechanical properties of both alloyed and unalloyed grades, and comparative properties of titanium and other pure metals.

28 MECHANICAL SPRINGS — *Automatic Spring Coiling Co, Chicago 30, Ill.* 8-page brochure contains illustrated directions and instructions for specifying and ordering compression, torsion, extension, flat, and power springs.

29 COLD DRAWN STEELS—*Republic Steel Corp, Cleveland 27, Ohio.* 32-page illustrated booklet, Adv-672, summarizes properties and applications of typical grades of cold drawn carbon, free machining, stress relieved, leaded and alloy, and Enduro stainless steels. Data included on shafting, special sections, furnace treatment, and carbon correction.

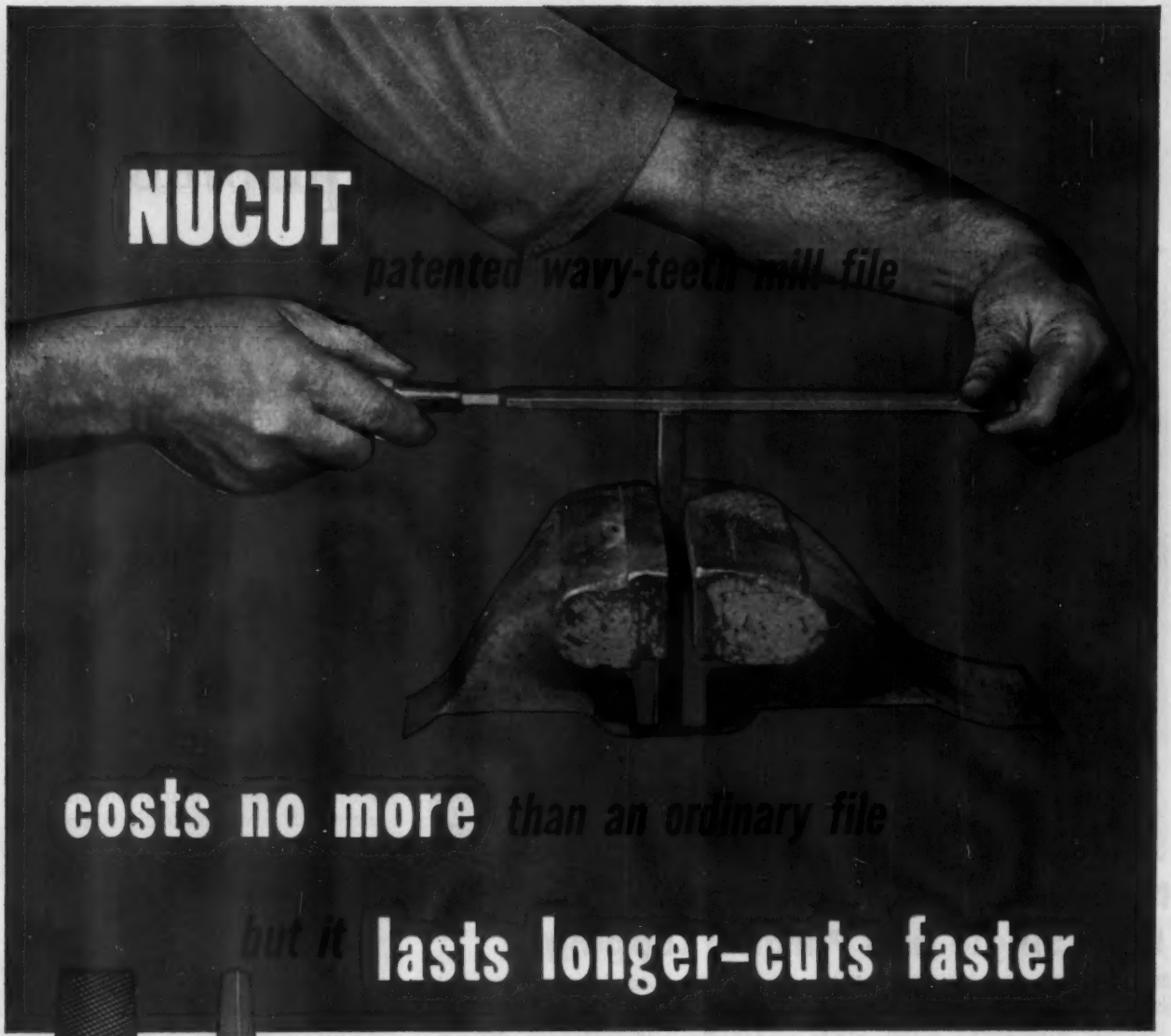
30 PILOT - OPERATED CONTROL VALVE—*A W Cash Co, Decatur, Ill.* 4-page illustrated bulletin 966 describes Cash Standard Type 10 recommended for air, water, light oils, various gases, non-corrosive fluids. Engineering data, construction features included.

31 PLASTICS—*American Agile Corp, Bedford, Ohio.* Condensed catalog of plastic welding and spraying equipment, large moldings, weldments and component parts for welded fabrications. Gives dimensions, thicknesses, ID and OD of pipe and tubing, and weights of various stock pieces of company's seamless ducting, sheets, rods, bars and blocks.

32 VARIABLE SPEED TRANSMISSIONS—*Sterling Electric Motors, Los Angeles 22, Calif.* 8-page illustrated bulletin describes Speed-Trol line with positive pulley adjustment. Data on factors in drive selection and varied automatic and remote speed control accessories available.

33 SEQUENCE VALVES — *Aircraft Products Co, Bridgeport, Pa.* 4-page illustrated data sheet covers Series 4000 line of slide-type units for 3000-psi hydraulic service with extremely low leakage and pressure drop. Operational details, sizes, temp ranges, and auxiliary relief valves available included.

34 STAINLESS STEEL TUBING—*J Bishop & Co Platinum Works, Stainless Steel Products Div, Malvern, Pa.* 8-page illustrated catalog 11 describes line of cold drawn mechanical, capillary, and hypodermic tubing; nickel and nickel alloy tubing, and tubular fabricated parts. Information on compartive analysis of alloy types, specifications, standard tolerances, physical properties, and workability.



costs no more than an ordinary file

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Heller NUCUT files combine coarse, fine and extra fine teeth in a planned irregularity, creating the "wavy-teeth" design. The coarse teeth cut deep, clean; the fine teeth leave a smooth, scratch-free finish. This "Wavy-Teeth" design makes the file clear itself, adds longer life. NUCUT "wavy-teeth" files cut faster without scraping or chattering. Ask your distributor for Heller NUCUT files with patented "wavy-teeth."

HELLER TOOL CO.

A Subsidiary of Simonds Saw and Steel Company

NEWCOMERSTOWN, OHIO

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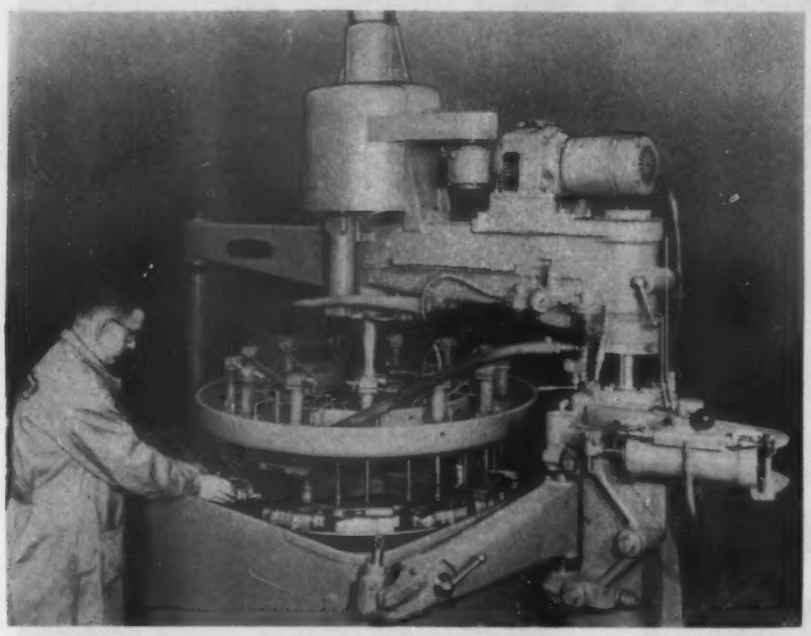


Norton No. 48F Hyprolap Machine Does Single and Parallel Lapping

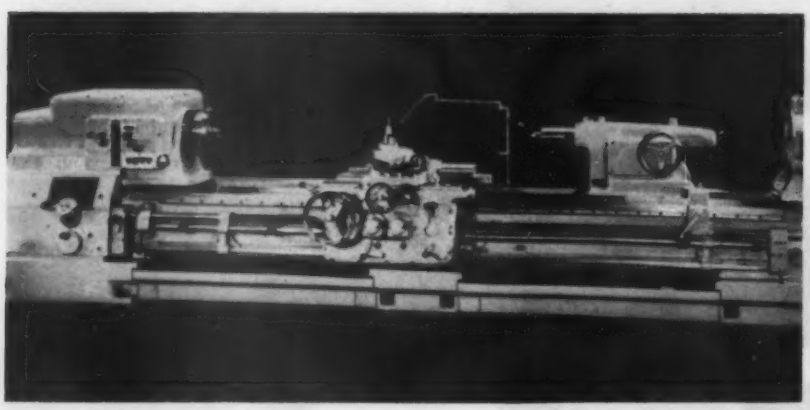
No. 48F Hyprolap is designed for either single or parallel face flat lapping, with plain, timed cycle; automatic continuous feed; or semiautomatic continuous feed.

For single-face lapping, the machine mounts a single 48-in.-diameter bonded abrasive wheel lap on vertical spindle. Work is retained in adapters, and proper lapping pressure is obtained with suitable weights or pressure devices. Truth of lap face is kept by column-mounted diamond truing arm hydraulically operated.

Opposed parallel faces are lapped simultaneously by mounting another lapping wheel on a column and overarm. Work is held in retainers between laps, and size is held by raising lower lap with "click-count" indexing wheel feed and rotating full nut engaging feed screw. Both hand and power feeds are available.

Plain cycle uses electric timer to control machine. Operator loads machine and pushes button to start cycle which is automatically stopped by timing device in the machine. With semiautomatic continuous feed, operator loads parts which are finished in single pass through the machine. Automatic continuous feed eliminates hand loading and unloading, replacing them with automatic handling equipment.

Norton Co, Worcester 6, Mass



Axelson 32-in. Engine Lathe Has 75-hp Spindle Drive

This 32-in. engine lathe has been completely redesigned, to take 75 hp drive. Horsepower indicator allows selection of feeds and speeds to give maximum power output during machining.

Two-shift lever changes spindle speeds. Standard foot-mounted motor is V-belted to headstock gearing without clutch. Starting and stopping of heavy inertia loads is by electrical plugging. For horsepower less than 75, a clutch is provided.

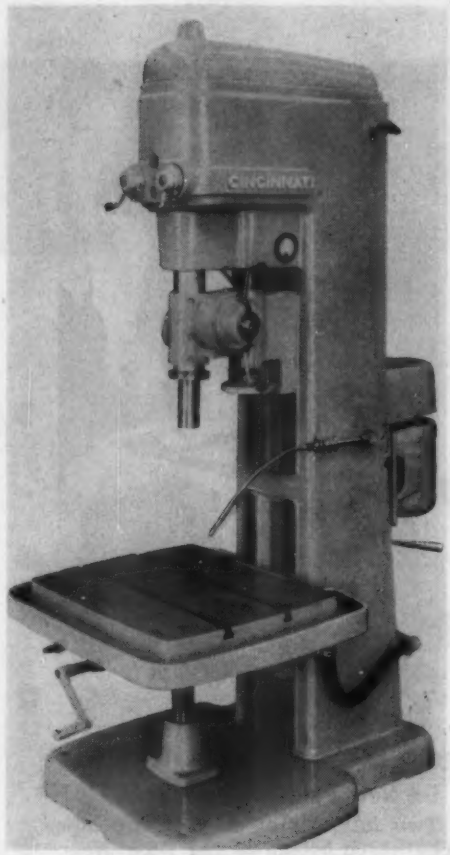
Spindle speeds are from 6 to 750, with 81 feeds, from 0.005 to 0.350 ipr. Thread range is 1 to 30 tpi. Threads and feeds are selected by a single lever and dial positioner in the gearbox.

Serrated clutches feed power into rack and cross-feed screw. Longitudinal rapid traverse lever is at left of operator. Taper attachment is 30 in. long, with maximum offset of 7 in. (16°).

Bedways are hardened and ground steel. Tailstock is one-piece construction, bolted to the bed. Sidewise movement is by gib on the back side of machine.

Axelson Manufacturing Co, Div U S Industries, Inc, P O Box 58335, Vernon Station, Los Angeles 58, Calif

Materials and Parts . . .



Cincinnati 21-in. Sliding Head Drill

These 21 - in. sliding head floor drills are available with box or round column, with box-column machines offered with multi-spindle arrangements. Machines are shipped complete with motor and controls. Electrical panel is built into machine, with safety interlock which prohibits opening panel door except when power is off.

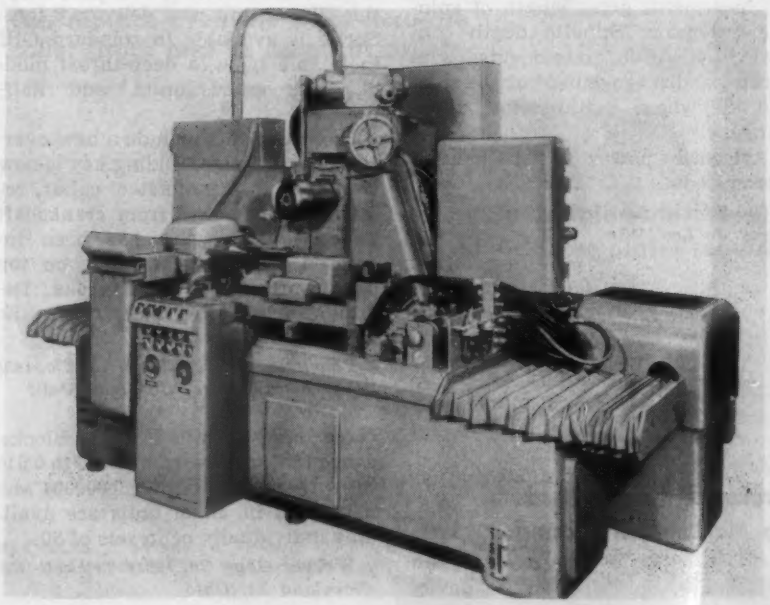
Transformer on all machines operating at 220 v or more cuts voltage at pushbutton station to 110 v, for operator safety.

Drills have geared power feed as standard. Selector is used to pick any of four feed rates which are engaged with positive-jaw clutch.

Feed rates are 0.004, 0.007, 0.010, and 0.015 ipr.

Spindle is mounted in tapered roller and ball bearings. Tilting motor bracket is said to ease speed changes. Machines are rated at 1½ in. in cast iron, with 2 or 3 hp, 1800 or 1500 rpm motor. No. 4 MT spindle is standard, with No. 3 MT spindle optional if specified.

Cincinnati Lathe & Tool Co, Cincinnati 9, Ohio



Automatic Gear Grinding Machines

Line of machines has these automatic features — loading, rejection of bad parts, stock equalization, down feed, and trimming.

Coolant is controlled-flow through the grinding wheel. Single or double diamond trimmers are said to offer excellent blend between root and fillet, and multiple trimmers shorten dressing cycle.

Time recorder accumulates total machine cycle time, for production control.

Gear Grinding Machine Co, 3901 Christopher, Detroit 11, Mich

. . . including

MACHINE TOOLS AND ATTACHMENTS

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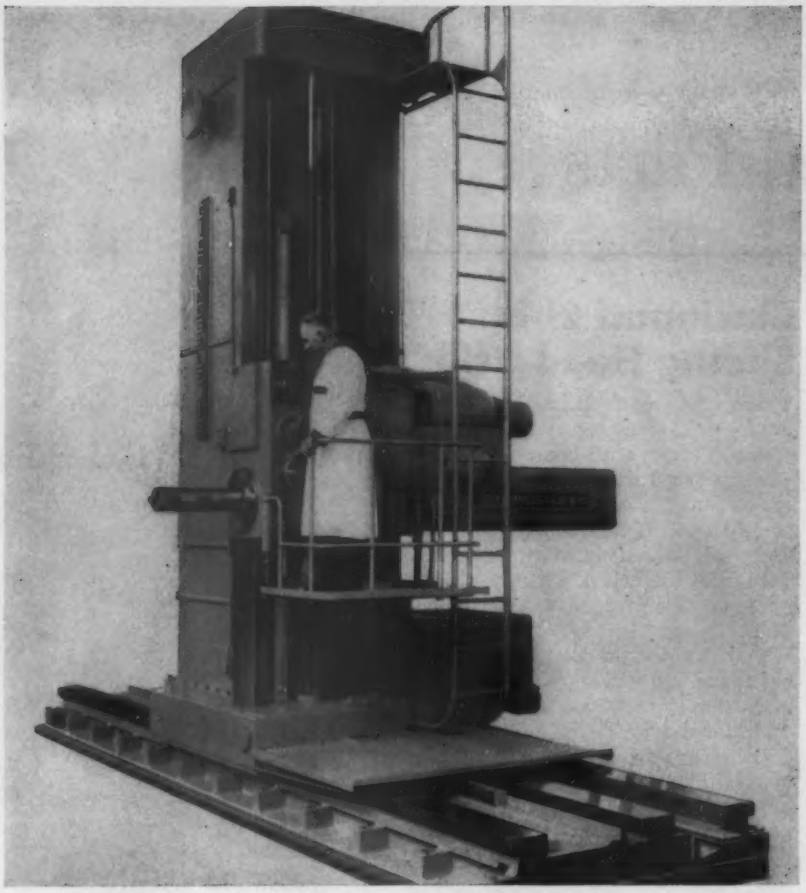


G&L Horizontal Boring Machine Is First of New 40 Series

460-FUAR has a 6-in. spindle, and is equipped with power motions, both for major movement and for inching. Spindle is driven by separate 30-hp motor, two other motors run headstock on column and column on runway.

Hydraulic clutches and electro-hydraulic units provide spindle movements, which may be actuated during speeds and feeds, and are pushbutton and dial-controlled.

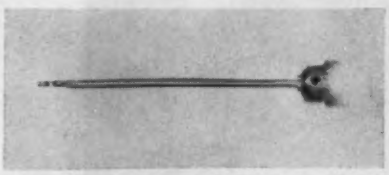
Optional built-in underarm support can be used with headstock and spindle; it is a rectangular-shaped ram that may also be used as a shaper or slotter. Underarm can be extended horizontally along with the spindle to provide rigid support for angular milling attachments, continuous-feed facing heads, and plate drives.

Spindle has 32 speeds from 3 to 800 rpm in four ranges; there are 18 feeds in each range, infinitely variable from 0.5 to 120 ipm. Rapid traverse is at the top feed rate. All machine functions are controlled at a fixed station on the headstock, except for spindle feeds and speeds. Spindle-control unit may be removed for remote operation.

Headstock, runway, and underarm are furnished with telescopes and direct-reading verniers for optical alignment. Counter reading in 0.001-in. increments gives length of spindle extension. Spindle depth control is in 10-in. increments, with electrical disengagement of the spindle anywhere within the 10-in. range.

Attached power hoist handles heavy tools.

Giddings & Lewis Machine Tool Co, Fond du Lac, Wis

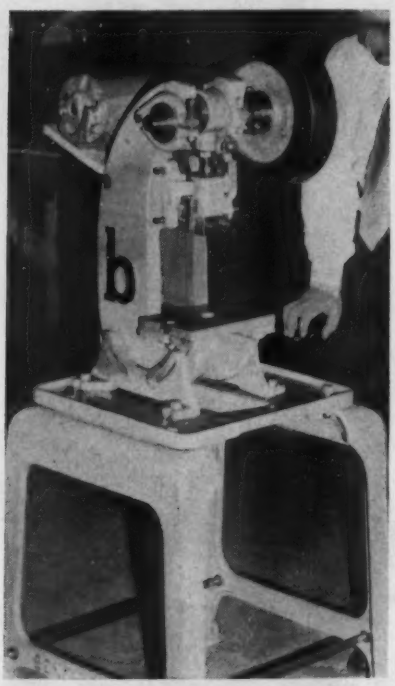


Broken Drills Are Used To Make a Drill Extension

Drill extension can be made by fitting a discarded drill into a device developed by Drilex Tools. It is said to be particularly useful for prolonging life of brittle cobalt drills.

Available in a wide range of sizes, unit is of one-piece construction, assuring a positive lock. Standard length is 10 in.; size range: No. 50 to No. 10; or 1/16 to 3/16 in. by 64ths.

Drilex Tools, Inc, 622 E Jericho Turnpike, Huntington Station, Long Island, NY



Benchmaster Increases Tonnage On New Punch Press Line

Two full tons of pressure are now delivered by the former 1-ton press; 4-ton model has a 5-ton capacity; the 7½-ton unit now delivers 8 tons. Series is available in standard OBI inclinable types, a deep-throat model, back-geared units, and half-presses.

Improvements include a new oversize clutch design. Sliding key is now contained in a large steel collar, removing entire load from crankshaft keyway. Brake size has been increased, with ram stopping on top dead-center after each stroke. Redesigned ram has locknut on the ball screw.

Benchmaster Manufacturing Co, 1835 W Rosecrans Ave, Gardena, Calif

Gage blocks, called Thin Blocks, range in thickness from 0.090 to 0.010 in. with accuracies of ±0.000004 and ±0.000008 in. Steel units are available individually or in sets of 30.

Webber Gage Co, 12912 Triskett Rd, Cleveland 11, Ohio

CUSHMAN chucks

give Chuck-ability

CHUCK-ABILITY: The ability to SPEED your work . . . ELIMINATE fatigue . . . IMPROVE your products . . . and REDUCE your costs . . .through design and selection of the right work-holding devices.

. . . the *New* Accra-Set Chucks

- **Ideal for precision bar work.**
- **Quick, simple, minute adjustment.**
- **Repeats within .0005" or better T.I.R.**
- **Because of extreme accuracy and jaw capacity, one Accra-Set* Chuck can replace *even* the most accurate collet chuck and its range of collets.**

*** Patent applied for.**

Available with 3 or 6 jaws in 6", 7½" and 9" sizes. Adapter plates required for mounting.

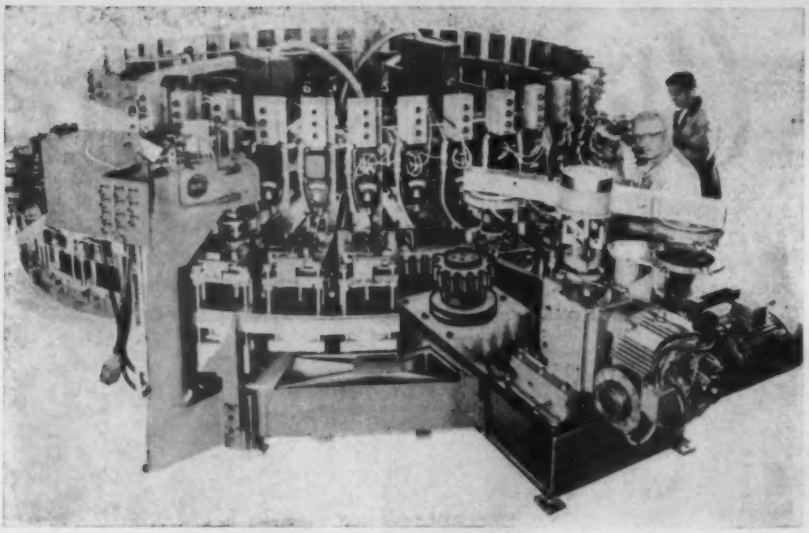
THE CUSHMAN CHUCK COMPANY
Hartford 2, Connecticut
a world standard for precision

CUSHMAN CHUCKS . . . a Product of American Quality, Labor and Materials.

SEE YOUR INDUSTRIAL DISTRIBUTOR

manufacturers of:

Air Operated Chucks, Cylinders, and Accessory Equipment . . . The Cushman Power Wrench . . . Cushman Manually Operated Chucks and Face Plate Jaws.



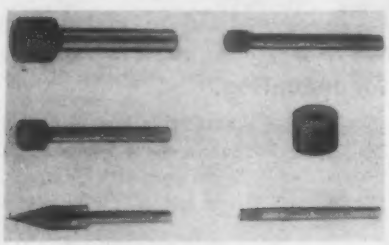
Power Takeoff on Loader Indexes Dial Table

Geared power takeoff on standard machine loader creates a single unit that loads, unloads, and indexes dial table. Unloading action is done by two horizontal arms that are carried on a vertical shaft. Spring-closed clamps on the end of each arm are arranged to slip over and grip the work when brought down on it at the unload station. Work is then carried to conveyor and released. Dial table is indexed by same motion that rotates arms during work transfer.

Mechanism can be equipped with various gear ratios to provide any number of indexes per revolution, and clamps can be designed to handle various pieces.

Clutch and brake permit unit to be started and stopped at any point in the machine cycle upon receipt of a signal from other machines.

Hautau Engineering Co, 721 Wanda, Ferndale, Mich

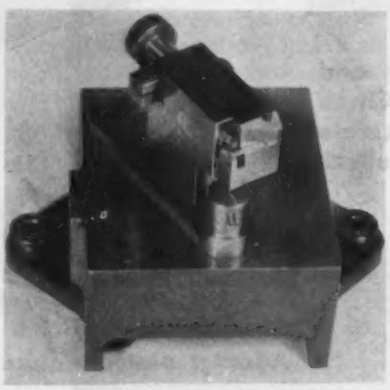


Diamond-Impregnated Wheels

Vinoy wheels contain crushed diamonds imbedded in a special carbide matrix. Tools are designed primarily for the carbide die industry, but may also be used effectively on other hardened materials, such as nitrided or case-hardened steels, according to the manufacturer.

Units are furnished standard in an 80-diamond mesh, and are available in ranges from 60 to 200 mesh. When worn down, diamonds are re-exposed in a bench lathe using No. 220 grit silicon carbide abrasive with a flat cast iron lap. This abrades the matrix and causes diamond particles to re-protrude.

Diamond Products, Inc, 332 Prospect Ave, Elyria, Ohio

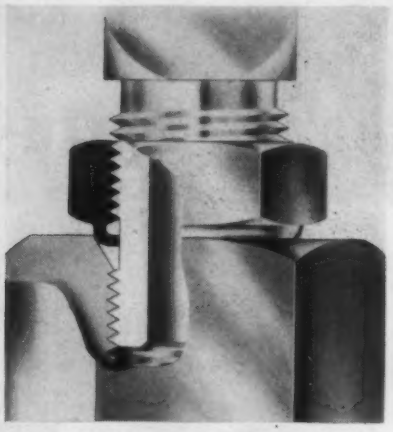


Drill Point Grinding Fixture For Crankshaft Pointing

Crankshaft drill point grinding fixture for drill sizes from No. 50 through 5/32 in. is designed to grind points at rate of 300 drills per hr.

Process consists of cutting away, or notching drill point in such a way that the usual chisel edge becomes a pair of secondary cutting lips, leaving minimum of web thickness at center. This is said to improve the cutting action; center of the drill, instead of smearing or extruding material under chisel edge, removes two clean-cut secondary chips. Crankshaft point is particularly adapted for deep-hole drilling and for processing stainless and tough alloy materials.

Schumacher Industries, 15500 Surrey, Livonia, Mich



Straight-Thread Positive Seal Hydraulic System Fittings

Type CN hydraulic fittings are said to provide straight-thread positive seal without overstress of port or fitting. Two kinds of ports are accommodated—L & L type and AND-10050. L & L port can be sealed with or without "O" ring, while AND-10050 requires the use of an "O" ring.

Fitting is available in range of shapes, including straight, 45° and 90° elbows, and tees. Sizes are for 1/8-to 2-in.-OD tubing.

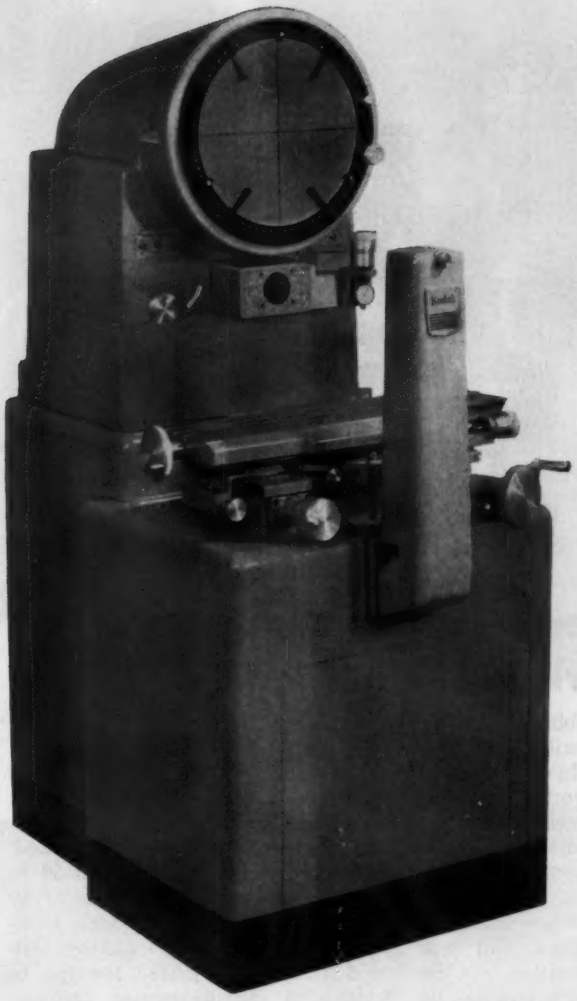
L & L Manufacturing Co, 8088 E Nine Mile Rd, Van Dyke, Mich

Carboloy Grade 350 and 370 Throwaway Carbide Inserts

Line of throwaway blanks, precision, utility, and end-on types is available in grades 350 and 370 for steel, and also in non-ferrous grades.

Blanks are in 9 basic sizes, with different radiuses, and triangular, round, and square shapes. Various thicknesses are available "off the shelf."

Carboloy Dept, General Electric Co, Detroit 32, Mich



Here's how Kodak combines added work capacity with 14-inch screen economy

in the new Kodak Contour Projector Model 14-5

If you make heavy, bulky parts to close tolerances, the new Kodak Contour Projector, Model 14-5, has a place in your inspection program.

For the 14-5 combines the heavy-duty work table and 8″ travel of the Model 30 with the economy of a 14-inch screen.

The result: a projector that makes light work of checking heavy parts.

Mechanically, the Model 14-5 provides a large (26″ x 8″) work table built to handle heavy loads without measurable deviation. A full 17.5″ throat clearance helps you position cumbersome parts quickly and easily. Table travel of 8″ in both horizontal and vertical planes speeds measurement. A built-in helix table rotates 15° in either direction for gaging threads or similar parts.

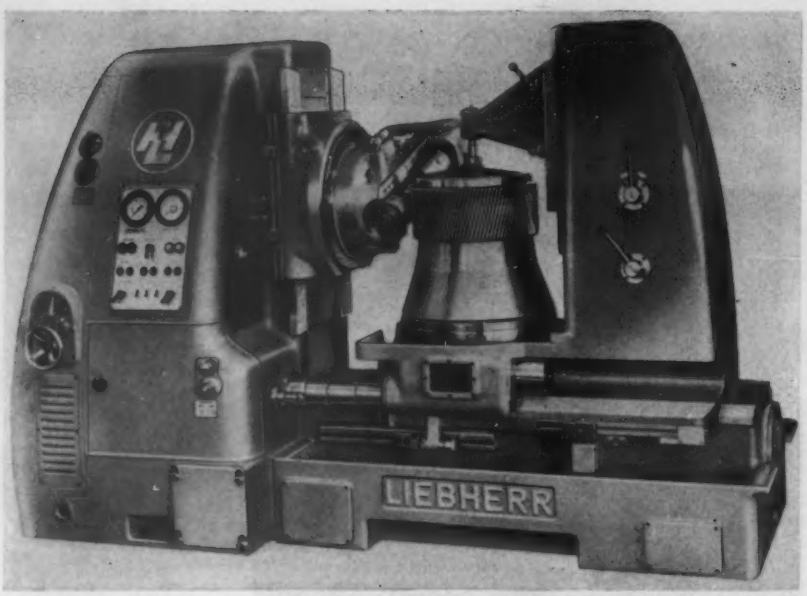
Optically, the Model 14-5 incorporates all the unique developments that have made the Kodak Contour Projector, Model 2A, leader in its field: bright screen image for easy reading, six-station lens turret for instant change of magnification, and self-contained Surface Illuminator.

For complete information on the Model 14-5, write for the new 12-page booklet "Projection Gaging with Kodak Contour Projectors." It tells how this new precision projector can help you check parts and components to accuracies of the order of .0001″—quickly and economically.

EASTMAN KODAK COMPANY
Special Products Sales Division, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADE-MARK



Liebherr Gear Hobbing Machines Handle Work to 118-in. Diameter

German-built gear hobbers can work gears to 118-in. dia with automatic climb hobbing cycle, hydraulic locking of table saddle, work arbor support swivel, and overarm. Control is automatic through adjustable cams and limit switches through contacts and magnetic clutches.

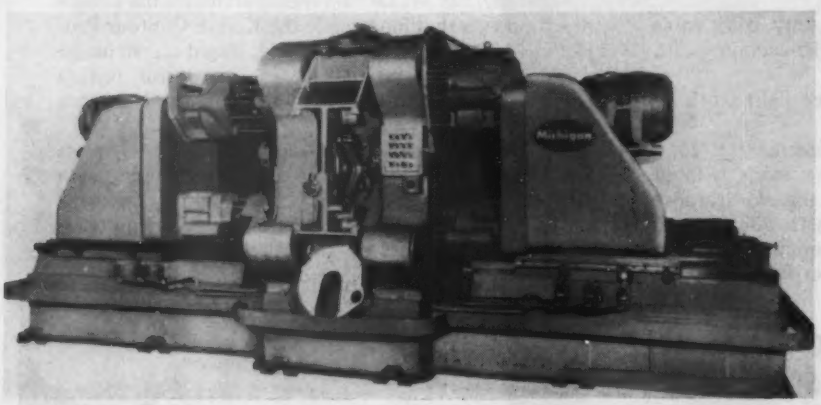
Main drive and feed are infinitely variable. Spindle speed and hob saddle feed per revolution can be read directly from dials, and can be changed while the machine is in motion. Hob spindle is worm-driven.

Index worm drive has special gearing and is supplied as standard with single-start worm. Two endwise adjustments for the worm take up backlash and axial clearance. Index worm is nitrided steel, and worm wheel and table are cast iron. Worm is automatically lubricated.

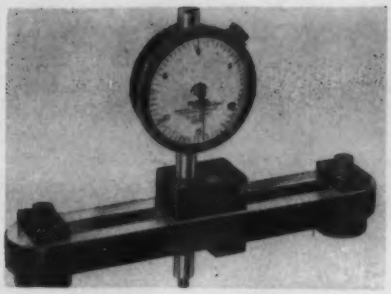
Operation is by pushbutton on a panel. All feed and rapid traverse motors are electrically interlocked.

Work capacity ranges from 20 to 118-in. dia, with hob speeds of 40 to 200 rpm for smaller models to 15 to 90 rpm for largest machine. Hob feed ranges are 0.008-0.154 ipr to 0.008-0.283 ipr, depending on machine size, and are infinitely variable. Table saddle feeds range from 0.004 to 0.073 ipr to 0.002 to 0.071 ipr. Smallest machine weighs 5.2 tons; largest, 52 tons.

Imported by Donald C Seibert, Box 281, Wilmington, Del



TRANSMISSION ADAPTER PLATES are processed on this special double-end trunnion machine. Unit drills, chamfers, and taps all mounting holes, and rough bores, finish bores and chamfers the starter hole at rate of 120 plates per hour. Pot-type heads are provided in each of the four stations; in the event of a part change, or a new model, only heads need be changed—*Michigan Drill Head Co, 1010 Beaubien St, Detroit 26, Mich*



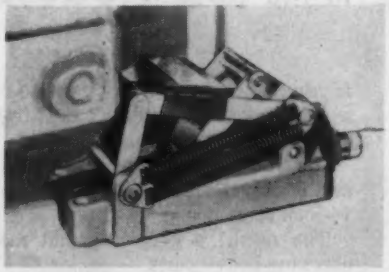
Federal Models 75 P-10 & 11 Adjustable Depth Gages

Two adjustable depth gages are said to eliminate need for designing special equipment for measuring wide range of work, such as slots, holes, recesses, grooves, and keyways. Model 75 P-10 will check depths from 0 to 1 in., and 75 P-11 will check from 1 to 2 in. Special contact points and longer contacts are available on request.

Dial indicator is adjustable vertically through range of gage, with locking screw to hold it in position. Auxiliary plunger relays measurement to indicator spindle. This plunger also protects spindle from eccentric loads, and is keyed to prevent rotation while gaging.

Rest pads, adjustable horizontally, are 1 in. in diameter, and may be adjusted from 2¼ to 6 in., center-to-center. Dial indicator is also adjustable horizontally between the rest pads, and may be located outside pads for overhang condition.

Federal Products Corp, 1144 Eddy St, Providence 1, RI



Automatic Stock Feed Incorporates Micrometer Control

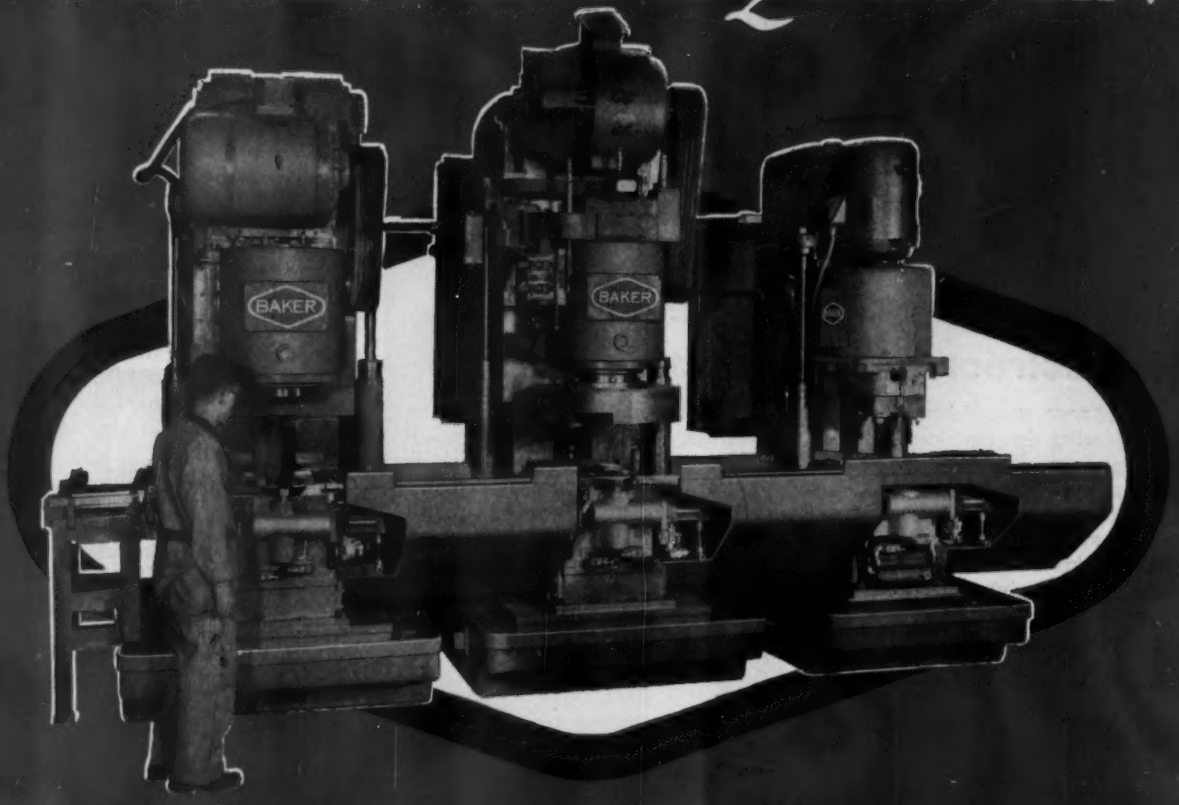
Automatic feed for coiled stock up to 2 in. wide, with max feed stroke of 2 in., has a micrometer adjustment to control length of feed travel to an accuracy of 0.001 in.

Jaco-Matic, said to be low in cost, is powered by the press ram, and feeds on either the up or down stroke. Tungsten carbide steel blade lifts clear of the stock on return stroke, permitting use for feeding soft stock without marring.

Jaco Devices, Inc, 90 High St, Hingham, Mass

The Average Shop Needs and Now Can Afford

AUTOMATIC EQUIPMENT

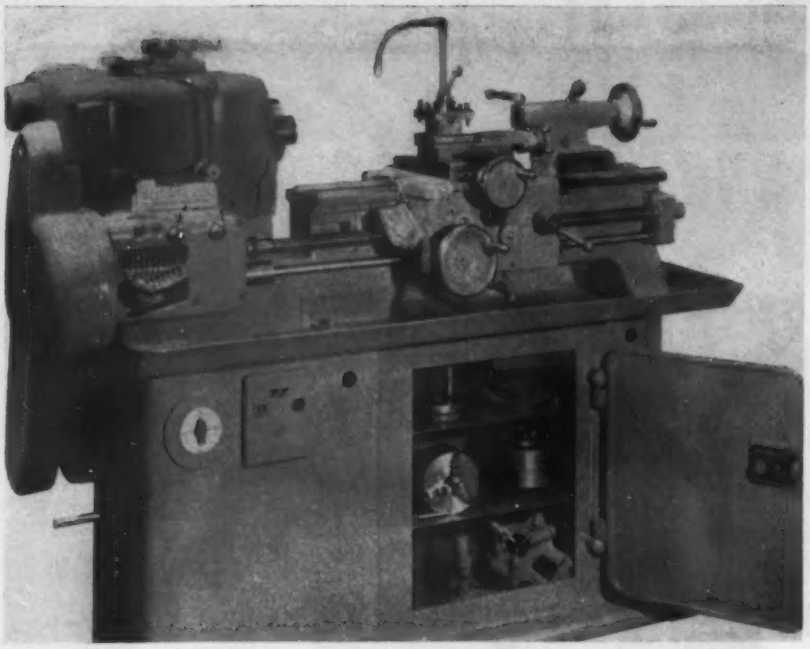


The new three standard unit Baker Machine introduced at the show, is combined to operate as a transfer machine, set up with a low cost, simplified fixture, proving the possibility of providing automatic machines through use of STANDARD MACHINES . . . And thereby achieving automation without tremendous expenditure. Operations on the new Baker Transfer are Combination Bore & Counterbore . . . Face (cross feed) . . . and Multiple Drill . . . All Automatically. Write regarding your specific job problems.

BAKER

Standard and Special
Drilling . . . Boring . . . Tapping
Keyseating and Contour Grinding Machines

BAKER BROTHERS, INC.
TOLEDO 10, OHIO



Harrison 11-in. Geared-Head Lathe For Toolroom and Production Work

Quick-change, geared-head lathe has 18-in. swing in gap, with 4½-in. width in front of faceplate. Available in 24 and 40-in. sizes.

All-geared headstock provides 8 spindle speeds, from 42 to 960 rpm, with alternate range available with 2-speed motor, giving 16 speeds, from 32 to 1440 rpm.

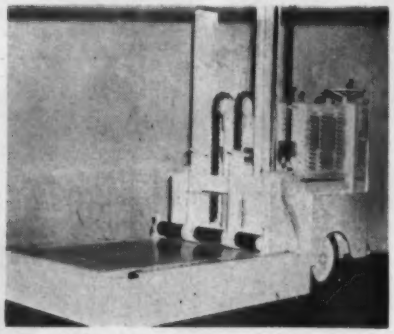
Spindle is splined, bored to take 1¼-in. bar, and mounted on Timken bearings at the front, with single-row bearing at the rear. Adjustment of bearing loading is provided.

Standard accessories include steadyrest, follow rest, drive plate, 9-in.-diameter faceplate, 2-cone center wrenches, and grease gun.

Stanley Sheppard, 30 Church St, New York 7, NY

Additional features: extra rigid quill construction to prevent spindle hangdown; protection to prevent surging on breakthrough; 3 drive arrangements; range of spindle speeds between 20:1 and 1320:1 ratios to cam speed; self-contained, automatic lubrication system.

Morris Machine Tool Co, 933-16 Harriet St, Cincinnati 3, Ohio

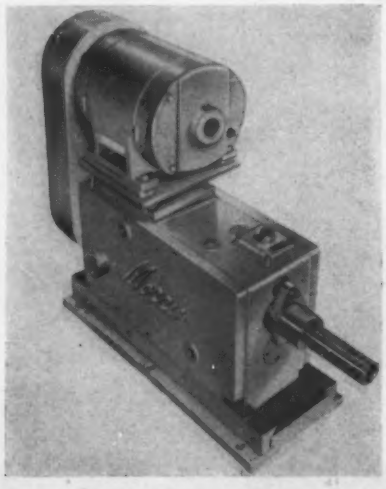


Hydraulic Die-Handling Truck In Small Capacity Model

Model E-12-16, a 16,000-lb capacity unit, has hydraulic lift and push-pull cylinders. Two remote control stations can be provided as optional equipment, as well as hydraulic power steer.

Over-all length is 152 in.; width, 60 in.; platform is 66 x 60 in. In low position, platform is 17½ in. from floor; for elevated operations it may be raised to 74 in. Unit is available in battery, gas-electric, or diesel-electric models.

Elwell-Parker Electric Co, 4205 St Clair Ave, Cleveland 3, Ohio

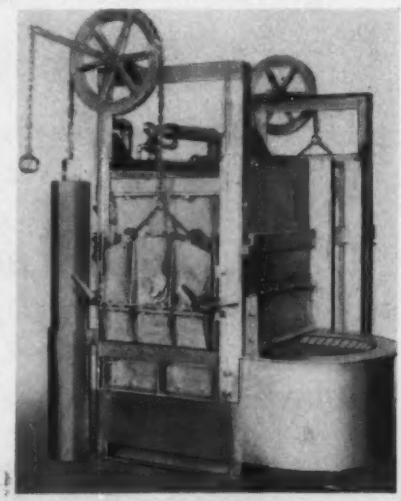


Morris Cam-Fed Drill Units Have Adjustable Thrust Control

Cam-Matic drill units perform drilling, tapping, and allied operations with automatically controlled operational cycles.

Compact machines employ an electric clutch in place of conventional linkages and power transmission devices. Adjustable rheostat permits sending varying amounts of current to the clutch for effective adjustable thrust control. Amount of thrust required may be dialed with rheostat dial. Clutch will slip if an obstruction is encountered, preventing damage to the unit and work. By adjusting the rheostat for thrust just beyond the maximum required for the operation, it is possible to use the clutch as a dull-drill detector. Warning buzzer or light may be wired into the circuit for an audible or visual signal when drill becomes dull or is broken.

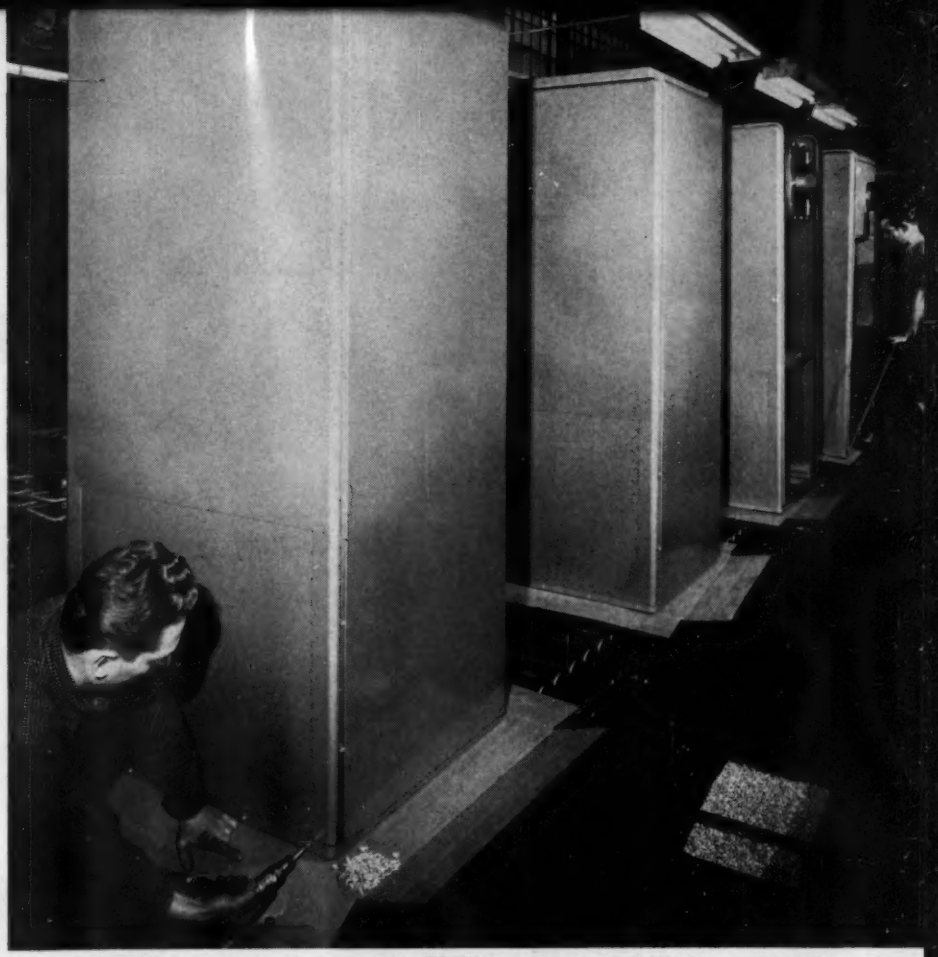
Heavy machined cam provides forward motion to the quill. Periphery of the cam determines rate of quick approach, drilling time, length of stroke, and rate of rapid return. Units are automatically cycled. Mechanical devices, traveling with the quill, trip limit switches to end the cycle or to reverse quill travel and spindle rotation for tapping operations.



REVERBERATORY FURNACE line is available in capacities from 400 to 2000 lb per hr. Temps are automatically controlled in breakdown and holding chambers. All metal parts exposed to direct flame or radiation are cast iron — *Johnston Manufacturing Co, 2825 E Hennepin Ave, Minneapolis 13*

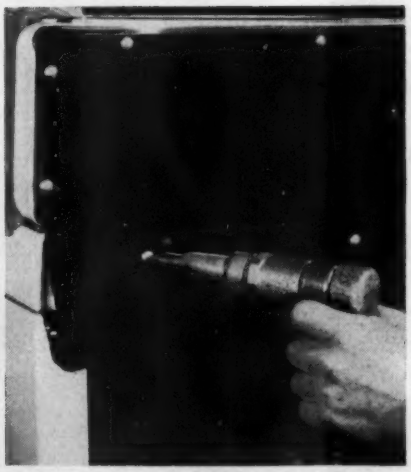
RESULTS SHOW IMPROVED PRODUCTION

...with Phillips
Cross-Recessed-Head Screws



ASSEMBLY LINE MIRACLES result from using Phillips cross-recessed-head screws in *all* Bryant Heater plants on heating, air conditioning and water heating units. Bryant's general assembly director says, "In all exterior or interior applications it is important that we use screws that incorporate easy assembly with rigid fastening — that means Phillips."

QUICK, EASY INSTALLATION applies equally to Fleetlite — "America's FINEST Windows" — and to the Phillips cross-recessed-head screws which assure sturdy, rigid, long-lasting *precision* construction. Says plant manager of Fleet of America, Inc., maker of these windows, "Phillips screws complement the high standards of our extruded aluminum construction. We use them exclusively."



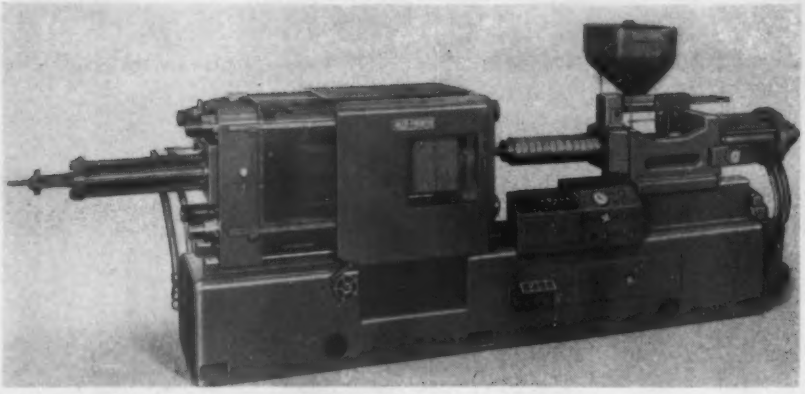
"NEATER APPEARING RANGE through the design of the Phillips screw head," says Assistant Superintendent of Tappan Stove Co., Mansfield, Ohio, founded 1881. "In addition, these screws improve production, speed assembly — and offer several safety factors. They have gained the approval of the men who use them."

• MANUFACTURERS OF • PHILLIPS CROSS-RECESSED-HEAD SCREWS

THE FASTENERS
OF TODAY...
AND OF THE FUTURE

✕ *marks the spot*
... the mark of extra quality

Allmetal Screw Products Company, Inc. • American Screw Company • Atlantic Screw Works, Inc. • The Blake & Johnson Co. • Central Screw Company • Continental Screw Company • The Eagle Lock Company • Elco Tool and Screw Corporation • Great Lakes Screw Corporation • The H. M. Harper Co. • The Lamson & Sessions Company • National Lock Company • The National Screw & Manufacturing Co. • Parker-Kalon Div. General American Transportation Corporation • Pheoll Manufacturing Co. • Rockford Screw Products Co. • Scovill Manufacturing Co. • Shakeproof Div. Illinois Tool Works • The Southington Hdwe. Mfg. Company Sterling Bolt Company • Universal Screw Company • Wales-Beech Corp.



Reed-Prentice 300TA 12/16-oz Plastic Injection Molding Machine

Dry cycle time of plastic injection molding machine is 10 sec. Built-in stuffing arrangement makes possible production runs of parts weighing 16 oz, through multiple strokes. In full automatic operation, a low pressure die closing unit prevents damage to machine, in case a molded piece fails to eject.

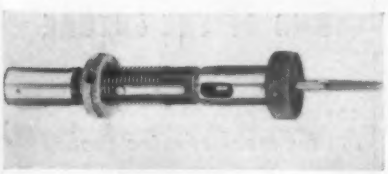
Machine controls, grouped in a newly designed operator's panel, govern movement of die and plunger, and adjustment of mold, heating cylinder, and die space.

Three proportioning-type pyrometers provide 3-zone temperature control of heating cylinder, with rated capacity of 115 lb of thermoplastic material per hour. Heating elements are ceramic.

Mold platens measure 29 x 32½ in., space between tie bars is 15 x 20½ in., and rated projection casting area is 150 sq in. Mold clamping stroke is adjustable between 7½ and 12½ in.

Double toggle shear is said to develop 300 tons positive mechanical mold clamping pressure. Safety door at front of machine has electrical and hydraulic interlocks, so that mold opens during any part of cycle when door is opened.

Reed-Prentice Corp, Worcester 4, Mass



Scully-Jones Tap Holders For Multi-Spindle Work

JT lock-and-eject collet-type compression and tension tap holders compensate for variations between feed of spindle and lead of tap. Tools are designed especially for multiple-spindle machines which take adjustable-adapter-shank tools.

Holders are said to eliminate need for leadscrew on many operations, with several pitches of taps possible without feed changes. Compression holder is used when spindle feed is greater than lead. Tension holder is for jobs where spindle feed is less than tap lead.

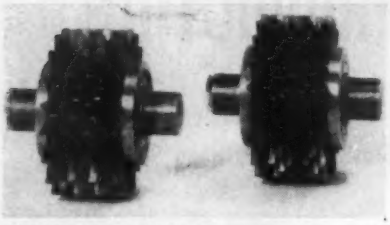
Compression holder prevents tap damage when previous operations have failed to provide holes in work. Spring permits sleeve to slide in the shank, provided stroke is equal to or greater than depth of hole being tapped.

Taps are said to run accurately within 0.002 in. 4-slot design of lock-and-eject chuck provides collet action.

To change taps, it is necessary only to turn the threaded nut to seat or unseat the chuck. Nut revolves freely on ball bearings, and lock-and-eject feature is said to eliminate pounding and torsion when changing tools. Depth adjustments are possible with quick-lock nut which locks any place on threaded shank of holder.

Each holder may be used for wide range of sizes by changing lock-and-eject tap chucks. Only seven basic assemblies are required.

Scully-Jones & Co, Chicago , Ill

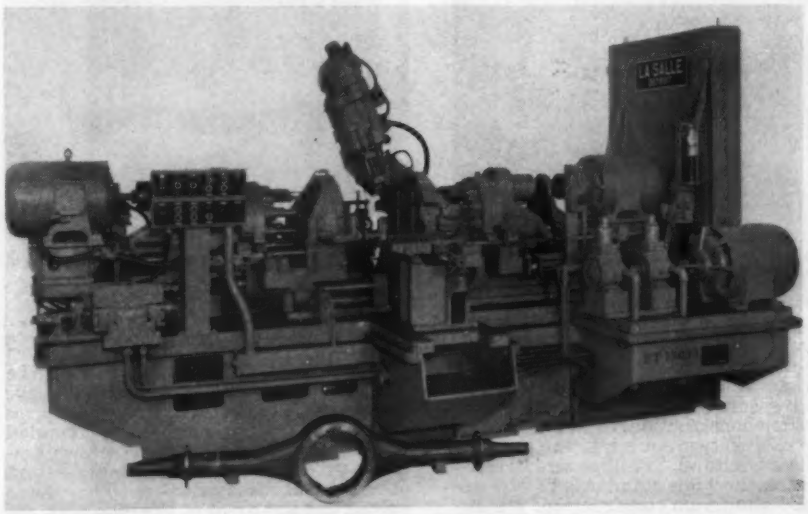


Ball-bearing Wheel Dresser

Ball-bearing mechanical wheel dresser, designed for roughing operations, is recommended for heavy duty dressing to open wheels for free-cutting action. Suitable for disk, spring, and snag grinding.

OD of tool is 2 3/8 in., and teeth are 7/16 in. long. Cutters are arranged in staggered position, secured at both ends of the sleeve. Ball bearings prevent contact between sleeve and cutters.

Aer-O-Matic Tool Co, 5099 W Diversey, Chicago 39, Ill



REAR AXLE HOUSINGS ARE AUTOMATICALLY DRILLED in this machine which is adjustable for any of six different designs of parts. Operations are set up with direct gage settings for each of the housings. Unit drills 20 holes—10 from each side, and the vent hole. Machine is self-contained, with hydraulic and coolant tanks located in the base. Built to JIC electrical and hydraulic standards, with automatic lubrication—*LaSalle Tool, Inc, 3840 E Outer Drive, Detroit 34, Mich*

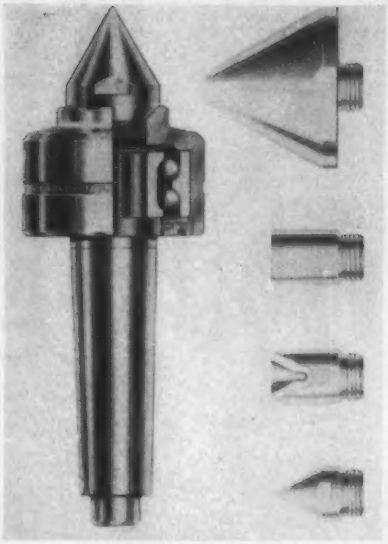
For Those Tough Special Jobs
Depend on

National Tool Co.

Years of successful experience in special tooling and related production problems are yours for the asking. When the job requires special cutting tools call in your National Tool Co. representative. He is backed by more than 49 years experience in the engineering and manufacture of special cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

National Tools Cleveland

National
TOOL CO.
Cleveland 2, Ohio



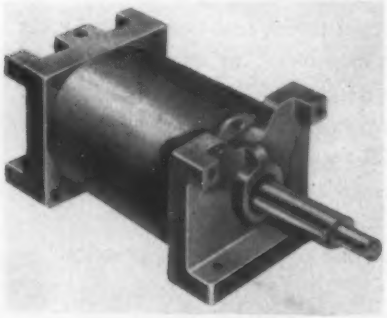
Red-E Shank-Design Center Has Interchangeable Points

Points for these anti-friction ball bearing centers have perfectly ground threads to match those of the head for assured accuracy.

Four types are available: standard male; standard female; standard round blank (soft tool steel); bull nose. Sizes range from ½ to 3 in. in dia. Male, female, and bull nose are made of hardened alloy steel. Standard male point is furnished with the shank center or the type point desired, if specified; these are ground on the centers with which they are to be used.

Centers are made in all tapers and shanks, and have a short overhang so that work is close to tailstock. Accuracy is held to less than 0.0001-in. total indicator reading.

Ready Tool Co, 554 Iranistan Ave, Bridgeport 5, Conn

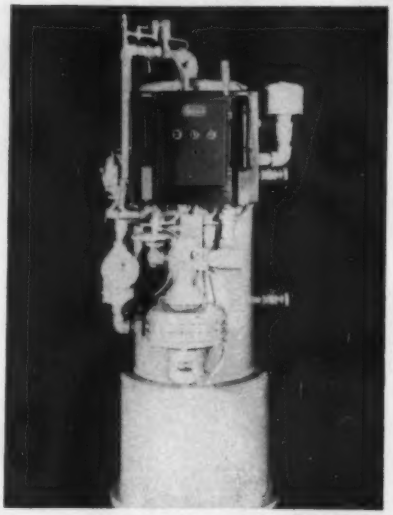


Cylinder's Piston-Rod Shape Eliminates External Guides

Single-action, push-type cylinder, with a spring return, is designed for clamping, ejecting, stamping, staking, locating and similar operations. Incorporating a hardened and ground elliptical piston rod which cannot rotate, it eliminates need for external guide bars or ways, reducing fixture setup time. It is said to meet any mounting requirement and is easily attached or removed. Both heads permit either flush or foot mounting to a horizontal or vertical plane.

Available in six sizes, cylinders range from 5 to 8 in. long, and from 3 to 5⅜ in. in width and height. All sizes available mounted on ¼, ½, and ¾-ton arbor press at 100-lb pressure.

Alkon Products Corp, 200 Central Ave, Hawthorne, NJ



Ipsen Exothermic Generator X-1250

Unit will produce up to 1250 cubic ft hr of exothermic atmosphere from either natural or manufactured gas. Unit consists of combustion chamber, air-gas metering and mixing system, premix gas burner, water-cooled gas coolers, and water trap, together with necessary automatic controls, regulators, and safety devices.

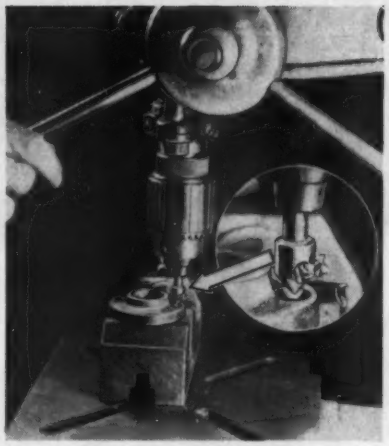
Outer shell is made of steel plate, including double-walled water jacket. Combustion chamber is refractory-lined, with sealed premix burner and positive piloting. Constant-pressure centrifugal pump and mixer regulate air-gas combination.

Constant-ratio mixture control gages and starter are mounted on a control panel at front of unit. Drying towers are available where low dew points are essential.

Ipsen Industries, Inc, Rockford, Ill

Solid tungsten carbide drill jig bushing, with full drill bearing surface, is available in all ASA tolerances and types, as well as for special requirements.

Acme Industrial Co, 209 N Laflin St, Chicago 7, Ill

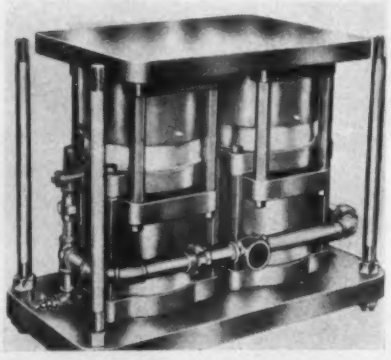


New Design for Countersink

Raymac countersink has a flattened non-cutting edge, higher than the cutting edge, which is on a rounded dip. A round chip-clearance hole is centered in the cutting edge, permitting smooth flow of chip waste. Design of the solid carbide cutting tool eliminates chatter or vibration, and insures exact cutting in one operation, according to the manufacturer.

Tool has an 82° included angle, and is available for screw size numbers 5, 6, 8, and 10. Larger sizes, 1/4 up to 1/2 in. can be furnished with or without a pilot to fit any diameter. Speed is 250 to 500 rpm.

Dexco Corp, Raymac Div, 15490 Dale Ave, Detroit 32, Mich

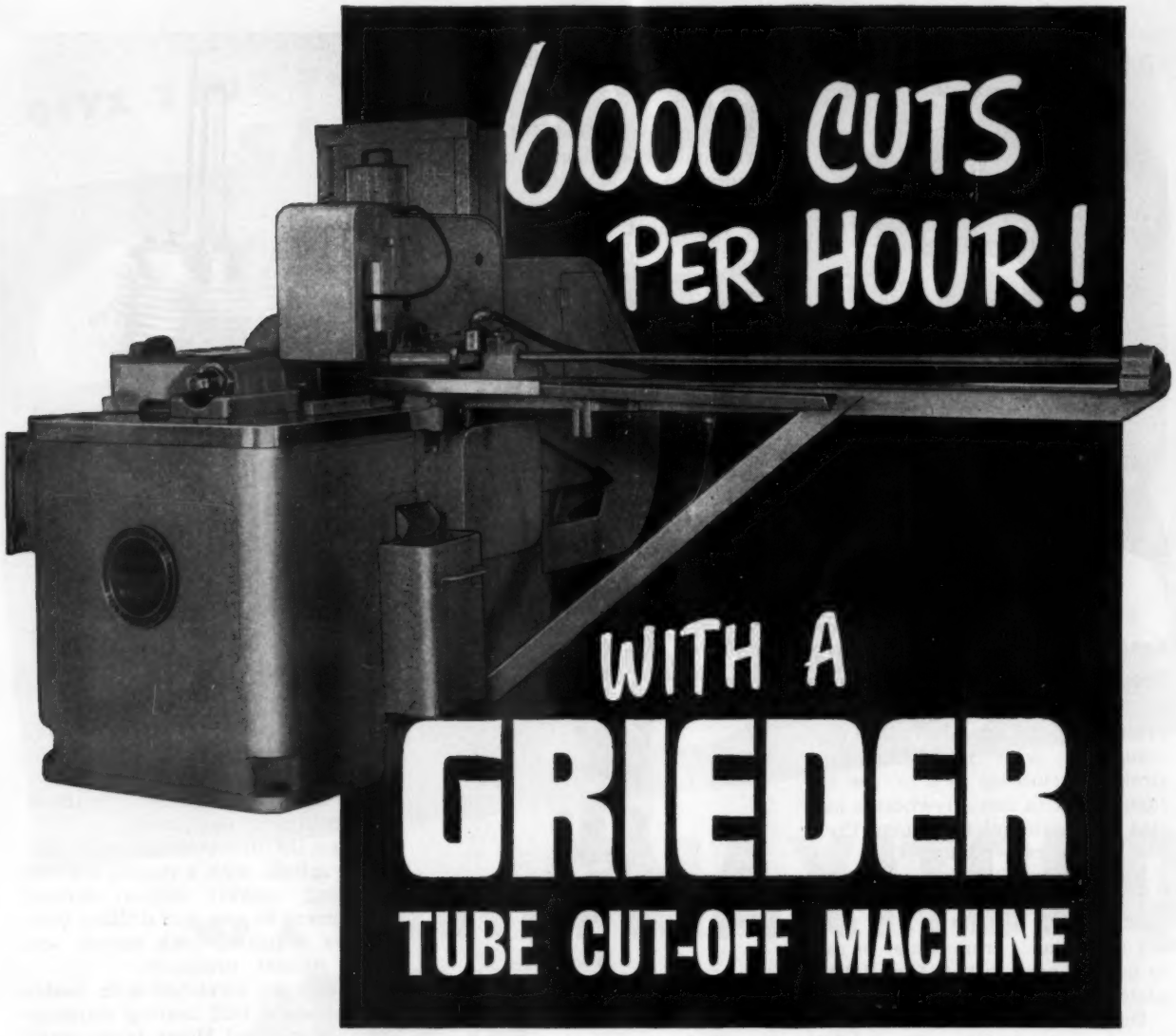


Pneumatic Die Cushion Equipment Has Improved Design Features

Model HCC-24-6 develops 180 tons on 100-lb shop airline pressure. It is provided with special booster pump to double shop pressure.

Cylinders and pistons are all-steel welded construction with bronze bearing surface on pistons. Lubrication system is centralized. Regulating valve and pressure gage assure constant ring holding pressure to desired working requirements of each die cushion installation.

Dayton Rogers Manufacturing Co, Minneapolis 7, Minn

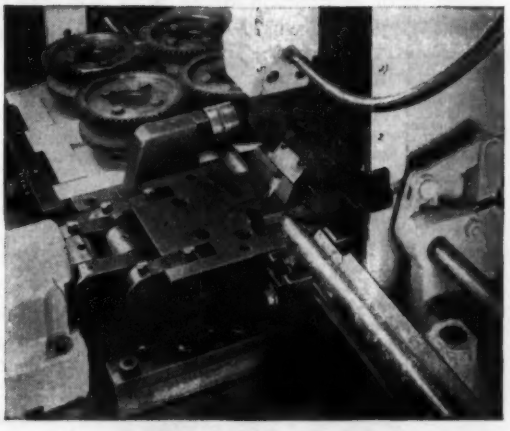


6000 CUTS PER HOUR!

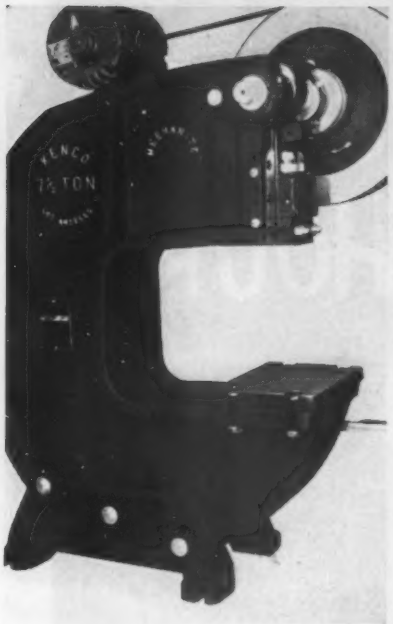
WITH A GRIEDER TUBE CUT-OFF MACHINE

NO DISTORTION... MINIMUM BURR...
ACCURACY WITHIN .002"...
CUTS ANY SHAPE...

Cut steel tubing at the amazing speed of 6000 cuts per hour. The Grieder Tube Cut-Off Machine features a heavy duty air operated combination clutch and brake unit that allows continuous operation at this terrific rate of production. Fully automatic... Rate of feed: 600 feet per minute ... True cutting. Get full information, multiply your tubing production, reduce costs, write *today*.



GRIEDER INDUSTRIES, INC.
BOWLING GREEN, OHIO



Kenco 7R 7½-ton Deep-Throat Press

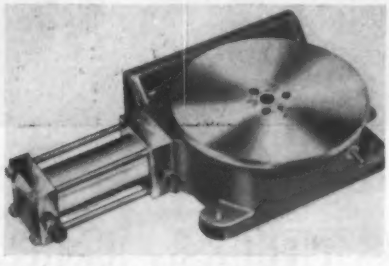
Model 7R is 7½-ton, 12 3/4-in.-throat press with solid, one-piece alloy-steel crankshaft with 1½-in. standard stroke. Strokes up to 3 in. are optional at extra cost. Flywheel is carried on double roller bearings. Press has V-type ram guides.

Ram hole is 1 9/16 in. in diameter, 2 1/8 in. deep. Ram size front to back and left to right is 11 ¼ x 16-1/4 in. Distance from center of ram to back of press is 12 3/4 in. Bolster plate is 7 1/2 x 11 x 1 in.

Driving mechanism is self contained in clutch collar. Flywheel is fitted with companion drive plate. Press is equipped with Kenco single-trip control, requiring one to two lb operating pressure.

Press is sold as bench model, with floor legs available at extra cost. Machine can be furnished in single- or double-hand control, or foot control, and is solid-back, inclinable.

Kenco Manufacturing Co, 5211 Telegraph Rd, Los Angeles 22, Calif



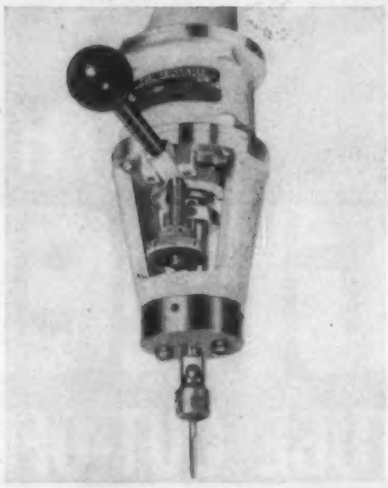
Indexing Dial Feed Tables For Limited-Space Areas

AllenAir tables, said to be guaranteed against override, have 24 indexes at 300 cycles per minute with a 40-lb load on the top of the 7-1/2-in.-dia plate. A 10-in. plate can be supplied.

Mounting is provided for either horizontal or vertical applications; compressed air is available through the center stud for actuating secondary equipment. Tables can be set for either 4, 6, 8, 12, or 24 indexes per revolution.

Model 725-EA is furnished without control valves; 725-EB is completely equipped for automatic operation and controls regulating dwell time and forward motion without electricity. Accuracy is ± 0.001 at periphery of standard top plate.

A K Allen Co, 57 Meserole Ave, Brooklyn 22, NY



Leadscrew Tapping Unit Has High Accuracy

After production line testing, Procunier Co reports uniform precision threads consistently maintained with ease, repeatedly producing parts with no rejects. Unit combines Procunier cork-faced friction clutch and Tru-Grip tapholder with new design leadscrew. It can be manually operated or adapted to air.

By depressing trigger arm (¼-in. travel) tap is fed into work automatically without pressure on tap itself. At conclusion of downstroke, clutch is automatically disengaged. Leadscrew backs out when trigger arm action is reversed.

Unit produces threads in any pitch from 20 to 80; tap capacity is 0 to 3/16 in. in steel with leadscrew travel of 1-3/16 in. holding class 3 fit with ease. The depth stop holds uniform depth to within 0.005 in. Unit is available in cover-clamping models to fit practically any sensitive drillpress.

Procunier Safety Chuck Co, 16-18 S Clinton St, Chicago 3, Ill

High-Pressure Coolant Transfer Cuts Drilling Time

Introduction of coolant under high pressure through a hollow drill permits holes to be drilled to close tolerances and high finishes with standard drillpress equipment.

Type DA units, combining a one-piece spindle with a rugged transfer housing, convert vertical drilling equipment to new gun drilling techniques requiring high speeds and high coolant pressures.

Models are furnished with double Sealol seals; ball bearing construction; a specified Morse taper shank for attachment to drillpress spindle, and a specified straightbore socket for the gun drill; speeds to 10,000 rpm, pressures to 1000 psi.

Sealol Corp, Warwick Industrial Park, Providence 5, RI

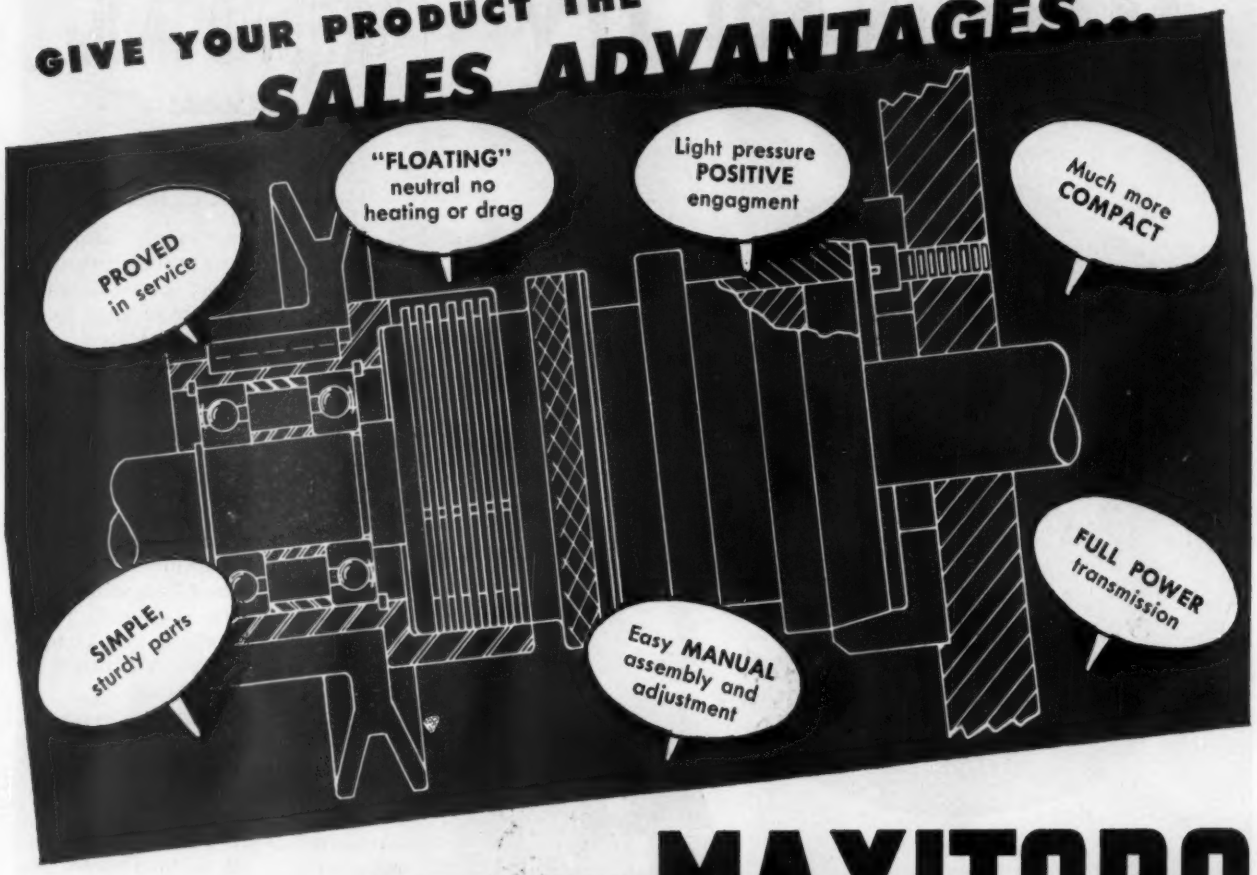
Surface-Mounted Diamond Tool

Permattach diamond tools are manufactured under a new process which "wets" the surface of the diamond, making it possible to fuze the stone to the tool by chemical union. Pressure and friction cannot weaken the bond, according to the manufacturer. Security of setting is guaranteed by the company.

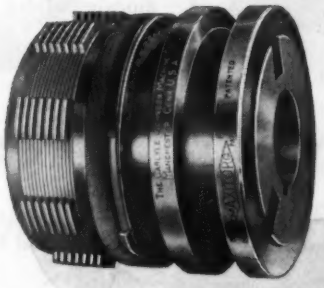
This fusion method eliminates need for imbedding three quarters of the diamond in the tool. Stones of any size and special shape can be surface-mounted on the shank, so that complete utilization of the stone is practical. A 1/3-carat tool is equivalent in exposed cutting surface to a conventional 1-carat diamond tool.

Permattach Diamond Tool Co, Milford, NH

GIVE YOUR PRODUCT THE SALES ADVANTAGES...

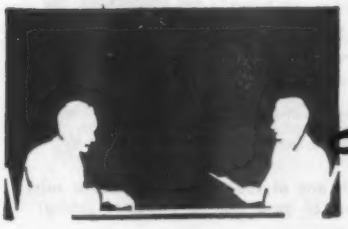


...OF A PROVEN MAXITORQ floating disc CLUTCH



The above line drawing illustrates a single MAXITORQ Clutch arranged for single V-belt drive with a special sliding beveled shifter sleeve acting as a light brake.

Yes, there are many types of MAXITORQ . . . single, double, overload release . . . to meet every installation need. Get our comprehensive technical data . . . let our engineering department help you work out special drive problems. Write or phone: Dept. AM-10, The Carlyle Johnson Machine Company, Manchester, Conn.



Let's talk MAXITORQ

5CJ55

MACHINABILITY INDEX 80-90*

PEARLITIC MALLEABLE CASTINGS

*B1112 STEEL = 100

Low machinability index of 80-90 (B1112 steel = 100) is probably reason enough to warrant serious consideration for your product.

But pearlitic malleable castings—from National—don't stop there. They have great ultimate strength . . . resist wear under heavy loads at high speeds . . . make excellent non-seizing bearings . . . can be air or liquid-quenched . . . can be smooth-finished.

Don't overlook the advantages of pearlitic malleable. For pearlitic malleable castings—from National—can often reduce manufacturing costs, weight and assembly time . . . can increase the sales potential of your product. AA-1806

NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY

Cleveland 6, Ohio

The Nation's largest independent producer of malleable and pearlitic malleable

ROUND TABLE Discussion

PICNIC OR CLIQNIC?

Are company-sponsored outings a morale-builder or a trouble-breeder? Do the shopmen feel it an obligation to attend? Is it better to keep work hours and off hours separate?

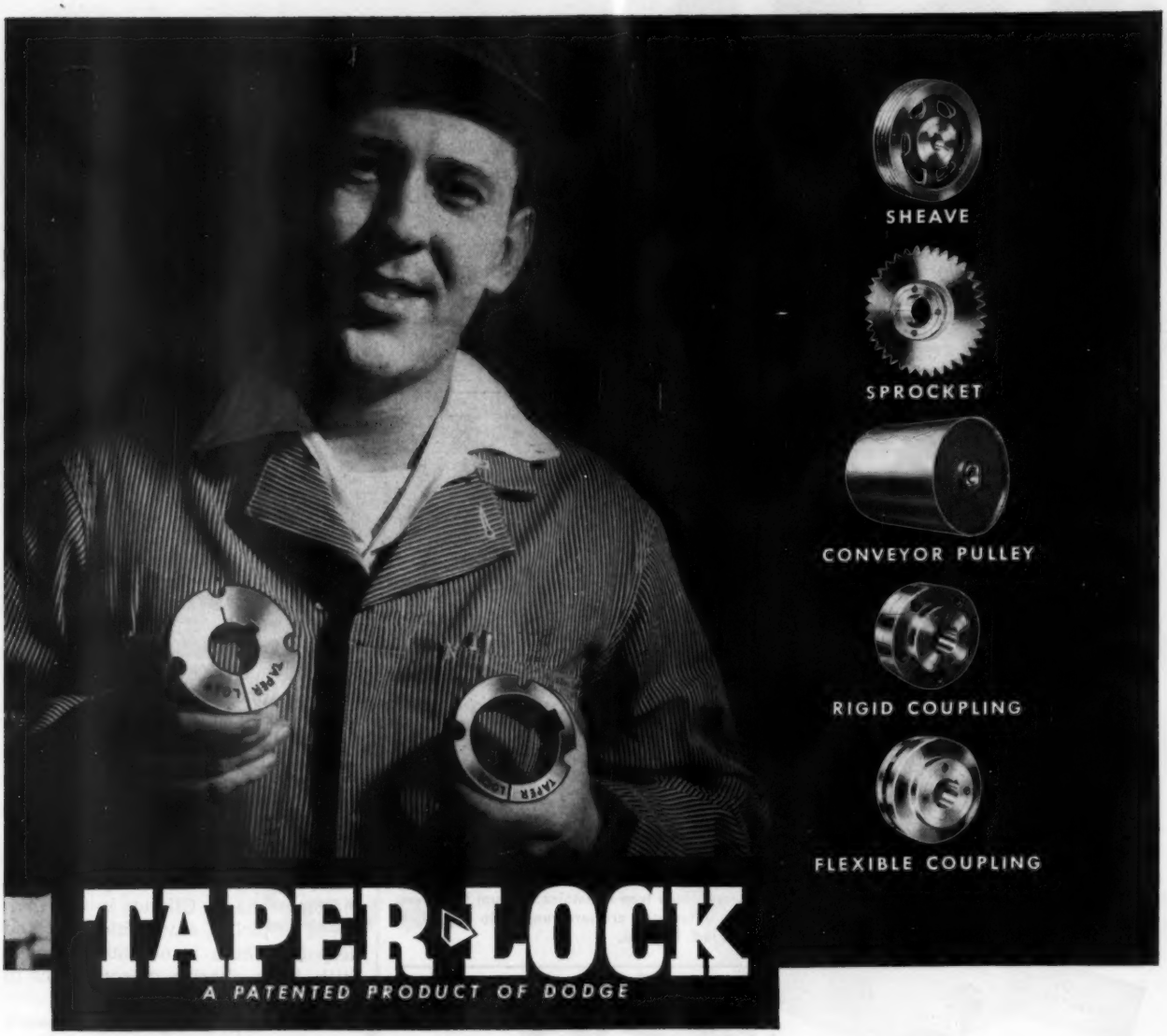
THE SUNDAY SCHOOL kids have a new beatitude: "Blessed are they who go around in circles for they shall be called big wheels."

Many big wheels in charge of such activities as community relations, public relations, and employee relations are going around in circles. Their job is to build up employee-morale and public good-will. Their aim, a worthy one, is to win friends and influence people on behalf of the free-enterprise system .

However, industrial employees are influenced more by politicians and union leaders than by spokesmen for the free-enterprise system. As the battle for the good-will of industrial employees goes on, members of management will not be found wanting.

Our friend Al, at least, will not be found wanting. Al's idea of reviving the shop picnic is a good one. It is a morale-builder. Employees get an opportunity to know each other better, to broaden their appreciation of

"And if one of the men asks about a raise, you sort of gasp and say, 'You're joking!'"



TAPER-LOCK

A PATENTED PRODUCT OF DODGE

"Brother...you sure can save with these interchangeable bushings!"

With a few Taper-Lock bushings you can make quicker changes and cut down-time on production machines—because Taper-Lock bushings are *interchangeable*. Shift from a Dodge sprocket to a Dodge sheave, and use the same bushing! Taper-Lock bushings are available in a range of sizes which makes changing from one size shaft to another equally easy and quick.

Mount 'em all with Taper-Lock bushings—your sheaves, sprockets, couplings, conveyor pulleys. They slip on the shaft quickly—hold with the firmness of a shrunk-on fit—come off easily without shock to bearings or machinery. Standardize, economize with Taper-Lock.

DODGE MANUFACTURING CORPORATION, 100 Union St., Mishawaka, Ind.

THERE'S ONLY ONE TAPER-LOCK, THE BUSHING THAT MOUNTS FLUSH!

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Machinery" in your classified telephone directory, or write us.

DODGE

of Mishawaka, Ind.

ADEL *Industrial Hydraulic Equipment*

for PEAK PERFORMANCE ADEL Hydraulic Valves and Pumps are setting new and ever higher standards for precision in manufacturing and efficient performance in operation. Following are but a few of the wide variety of models to meet all operating conditions.

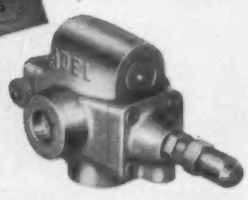
GEAR-TYPE HYDRAULIC PUMPS

For 1000 psi service with rated capacities at 1800 rpm of from 1.5 to 46.8 gpm.

DIRECTIONAL CONTROL VALVES

4-way valves with spring-centered, spring-offset, and 1, 2, or 3 position detent action. 1500 psi. Flows to 28 gpm.

RELIEF VALVES



Relief, Sequence and Unloading valves. Direct or remote operation, 50 to 1500 psi range.

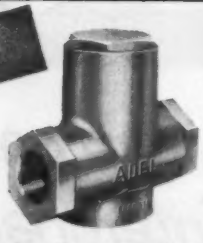
VOLUME FLOW CONTROL VALVES

Compensated type maintains constant flow over wide differential pressure range. No drain line required. 1500 psi.

PILOT VALVES

2 or 3 position detent. With or without dog or lever. Can be used as 4-way valve in small circuits. 1000 psi.

CHECK VALVES



Valves allow free flow in one direction only. Many variations available. 3000 psi.

For complete engineering specifications and counsel, Address: ADEL DIVISION—GENERAL METALS CORPORATION, 10767 Van Owen Street, Burbank, California.

ADEL PRECISION PRODUCTS
A DIVISION OF GENERAL METALS CORPORATION

Manufacturers of Industrial Hydraulic Valves and Pumps

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one another. It introduces the employer to the employee's family.

My wife and children think the enterprise which employs my services is the best. They speak well of it. They buy the products it manufactures. They have an interest in its welfare. Once a year my wife accompanies me to a dinner, dance, and entertainment supported by members of management, and goes to a Christmas Party supported by the shop workers. The four children look forward to the annual picnic.

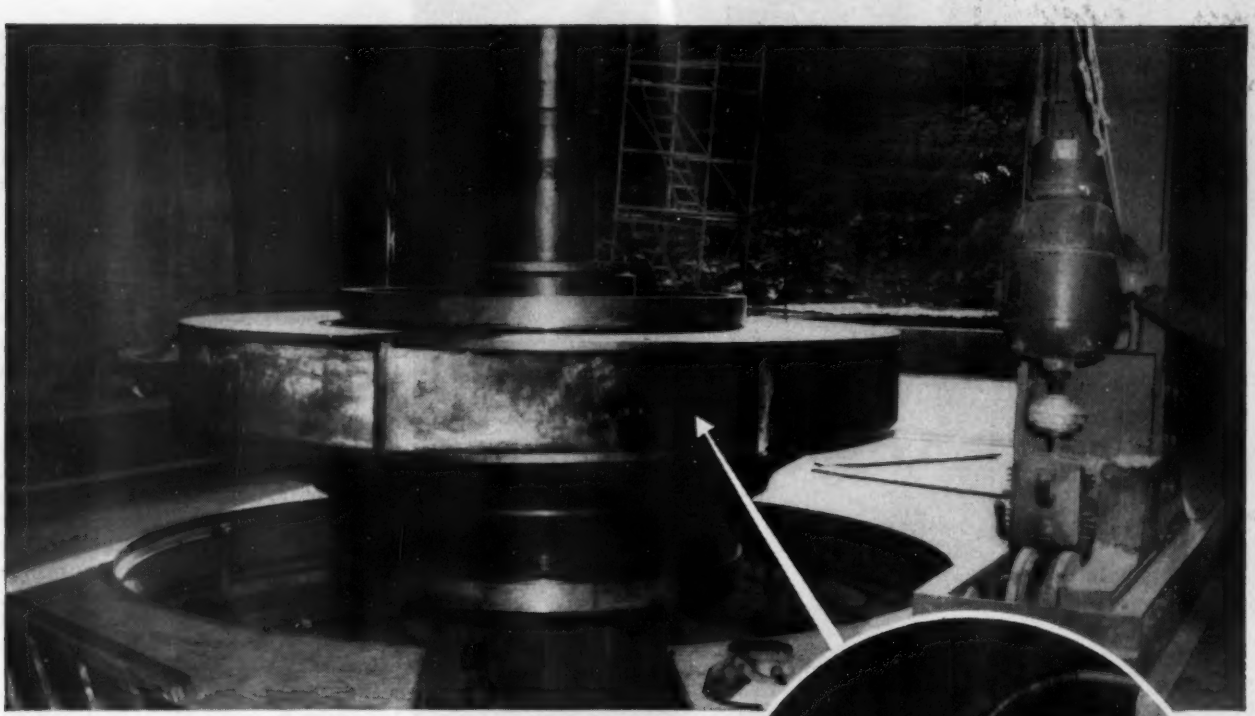
We go along with Al in using the shop picnic to break up the shop cliqnic. Cliques are in a class by themselves when it comes to sapping the life blood of a corporate enterprise. They can't be kept out of the shops operated for the absentee-owner, such as the stockholder. Cliques can be controlled, and are controlled by competent managers.

An enterprise itself is a big competitive clique. It strives to surpass other big competitive cliques in its chosen field of endeavor. A big clique cannot be successful if it is composed of small groups working, planning, and conniving for their special interests.

The rules of mathematics do not apply to human nature. Where cliques are concerned the whole is not equal to the sum of its parts. Where there is no unity there is incipient chaos. Cliques in the shop breed suspicion, envy, chicanery and despair. There is no mutual trust, faith, hope, charity, or confidence in one's future.

Men who play together will work together. Such activity increases morale, employee good will, and a

"Not only do we have plenty of work to do at the shop, but the boss keeps asking us to take home these 'Do it yourself' kits that he can't put together!"



Sigma welding has made the repair of these large pump impellers faster and more economical. Finished welds are a sound, homogeneous bond.

Sigma Welding Saves $5,000 per unit

Speeds repair of world's second largest pumps . . .

During operation, giant 20 ton manganese bronze pump impellers like this one, suffer cracks ranging in size from small sand inclusions, to cuts over a foot long. By using sigma welding, it is now possible to make high quality, on the spot repairs without disassembling the units — this results in an immediate savings of 5,000 dollars per pump.

Shown above is a typical repair operation on one of the 22,000 hp. electric motor driven pumps. This crack is 11-in. long, 2½-in. wide, and 2-in. deep. The four pegs adjacent to the crack are strain check points. Frequent measurements made of the distance between them determines welding duration and the peening sequence necessary to control distortion which in this operation was less than 0.005 inch. The completed weld made with aluminum bronze wire has an excellent surface appearance and color match.

You can speed production and cut costs in your operations—find out more about sigma welding from your local LINDE representative . . . Start saving now, call him today.

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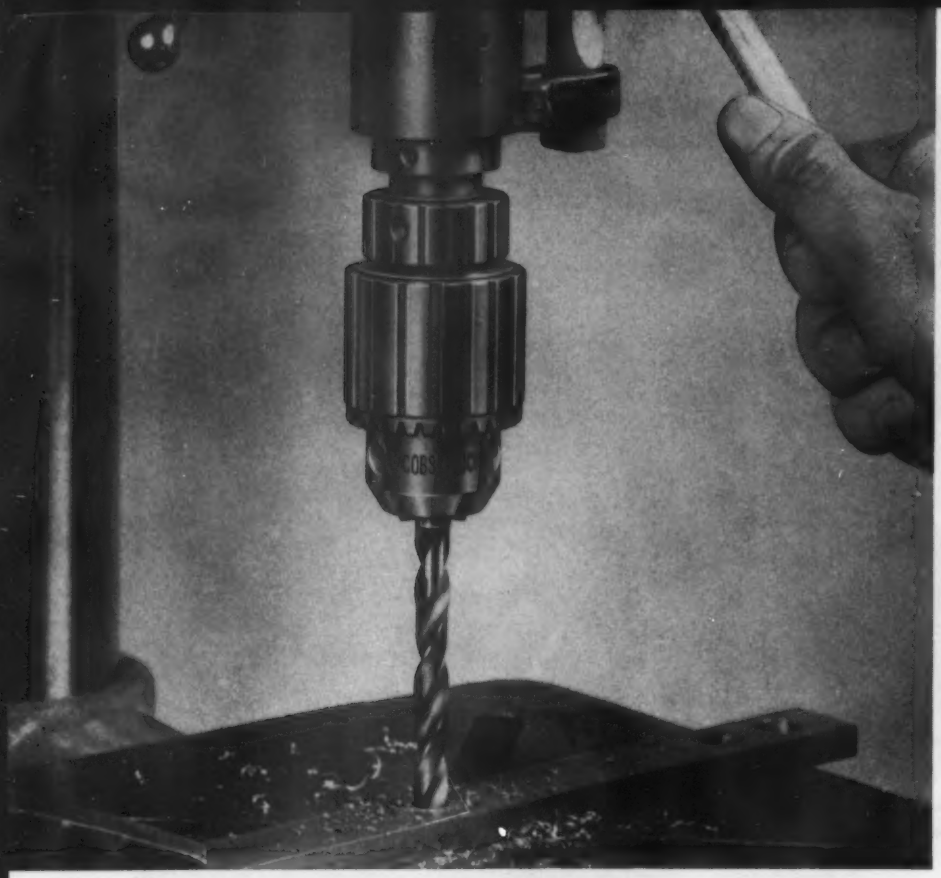

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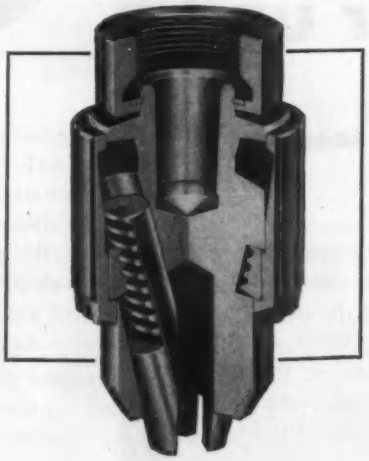
Jacobs Chucks for every tool and work holding need are as near as your industrial distributor. Call him for prompt, experienced service, or write The Jacobs Manufacturing Co., 1609 Jacobs Road, West Hartford, Conn. Ask for Catalog 100.



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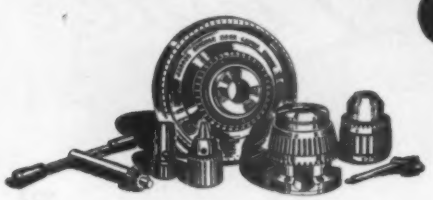


Jacobs
CHUCKS
If it's a Jacobs–it holds

competitive spirit. Use the shop picnic to get men who work in the same plant or building to play together. Use the picnic to break up the cliqnic.

Peter A Seward
Swampscott, Mass

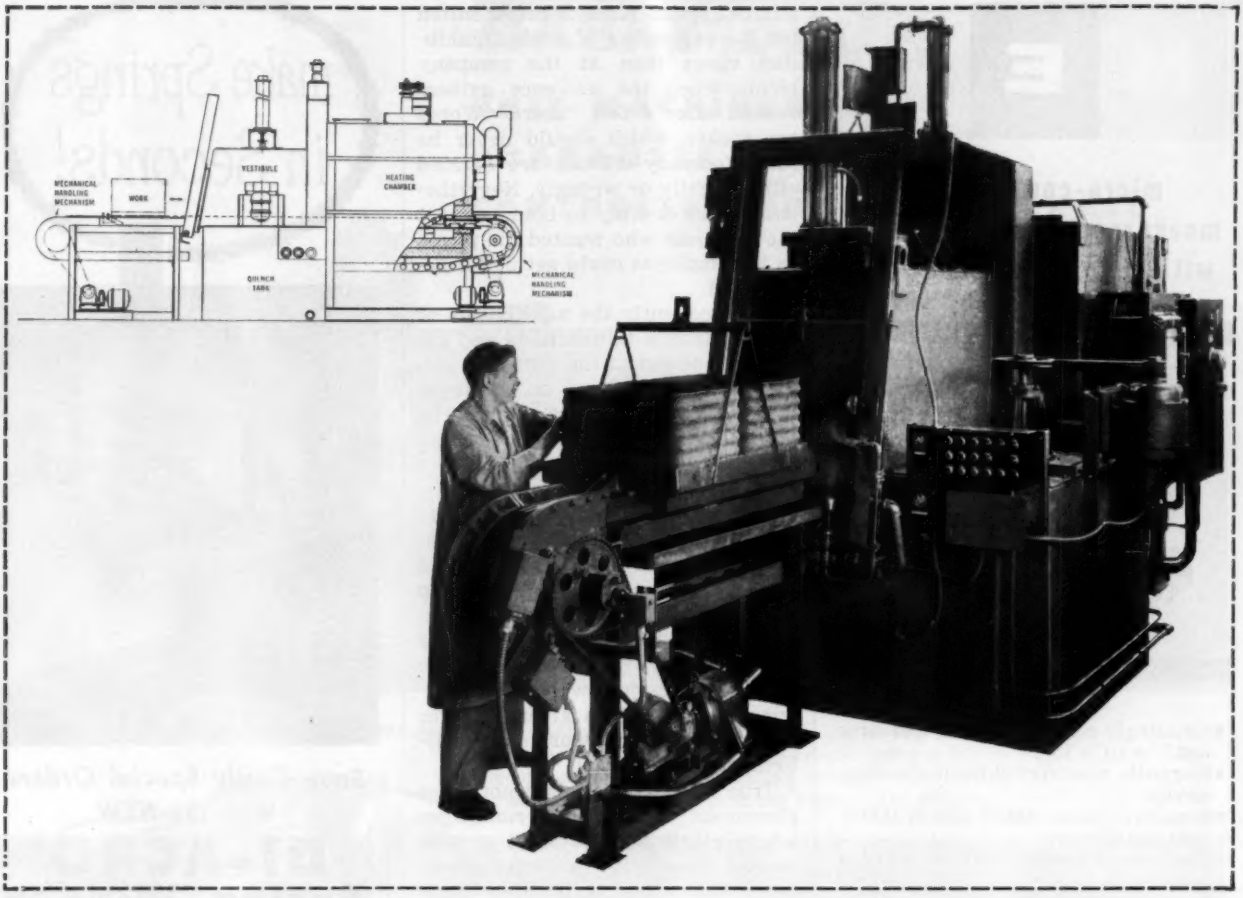
FOR ONCE Ed certainly has shown that good foremanship and the ability to get along with the workers is based on something else besides messing around with everyone's personal troubles.

Company picnics do not serve the purpose for which they are meant, and for many reasons. Oh yes, the thought back of it is about the same as Al pictures, but the results are far different. Actually, very few people like to be forced to go on a picnic; they resent being driven and told that today is the day you go on the picnic. Companies, in their great desire to show how well they take care of their employees, give little or no thought to an individual's rights or interests. It is the show that counts with the company. They give a company picnic as a part of their employee-relations program. It is a big thing.

We do find individuals who enjoy such parties as the picnics or office parties, but we can find many more who go because they have to and there are some who stay home and take the consequences of losing their jobs because they do not like to become part of a mass operation and involved in the incidents that too often occur at company picnics.

Improved relationship is never gained. In fact many times top officials find themselves "smack in the

"First I heard one, now I hear both our porters were in on that sweepstake ticket. Can't anyone give me the facts around here?"



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One of a new family of instruments based on the famous "T-42" Ionization Transducer, the Decker Micro-Comparator measures variation in dimension by detecting variation in capacitance, and expresses this capacitance change directly in a phase-sensitive d-c signal voltage.

Complete information on this unique new instrument is in Data Sheet 103-1, available upon request to Technical Literature Section,

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middle" for no place is better suited for the expressing of one's uninhibited views than at the company picnic when the audience gathers around after a few "beers." Words are spoken which should never be said. Company officials are berated either rightly or wrongly. Nevertheless no one is truly to blame except the top brass who wanted the picnic so the employee could get better acquainted.

Too frequently the top division of the company is thin-skinned and the remarks passed at the company picnic have caused many an employee to be actually laid off. Of course the lay-off is not attributed to such an incident, but rather it is part of a made-to-order incident later.

If a company really wants to improve human relationships and desires to become better known in the community, then they should give up the picnics and develop the "open-house plan." Here, under the proper planning, it is possible for entire families to see just what the breadwinner does and be given a better understanding of working conditions within the plant.

True enough, this might not be so glamorous for some companies whose plants are not ideal or who do not have good working conditions. Too often it is these companies who would rather spend money for the picnic than improve the working conditions. However, the over-all effects of the program are far better than a company picnic.

If more companies would remember that they hire a man for his working hours, and only pay him for

"This automation isn't all it's cracked up to be. I get pushbutton cramp every coupla months!"

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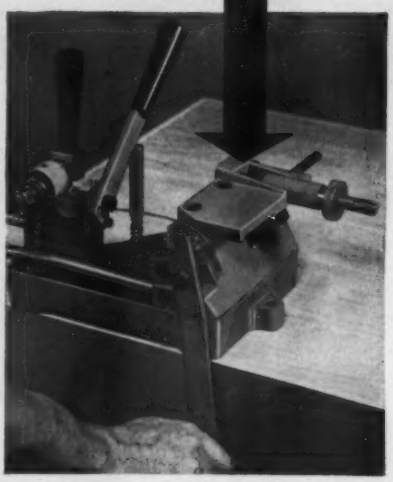

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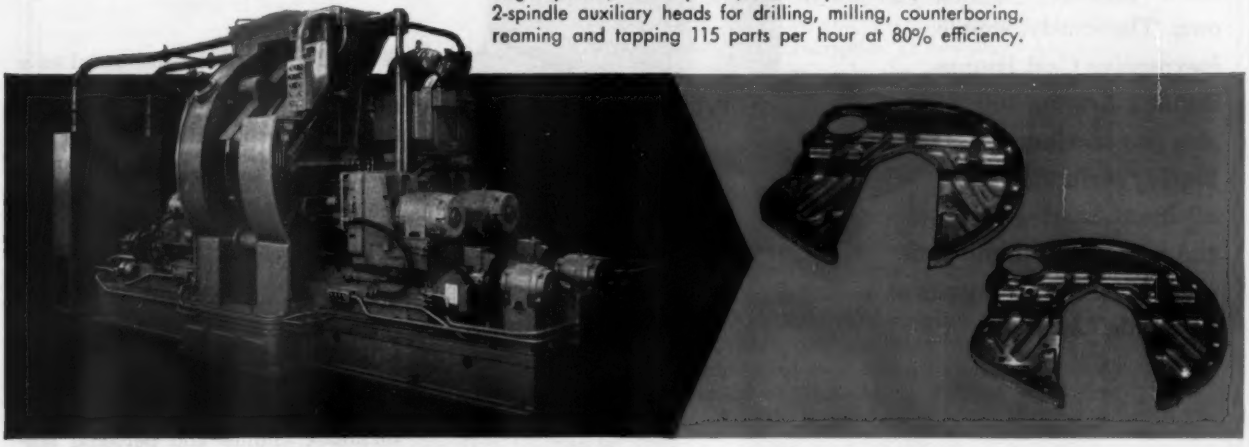

BARNESDRIL SPECIAL DOUBLE-END TRUNNION MACHINE for drilling, chamfering and tapping holes in aluminum housing adaptor plate at the rate of 70 parts per hour, 80% efficiency. Tooling includes two 16-spindle, one 11-spindle and one 10-spindle auxiliary head, and one 6-spindle and one 13-spindle lead screw tapping units.

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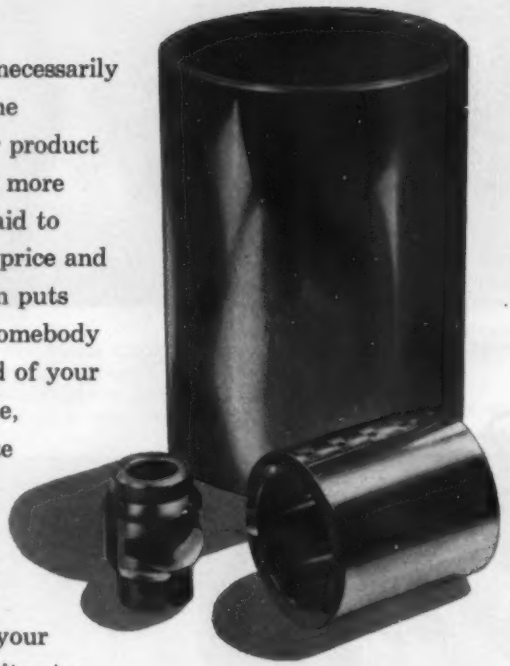

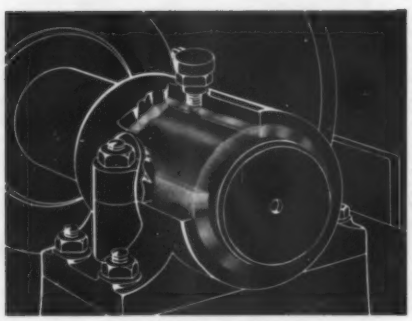

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those hours, and that his life is his own otherwise, it would be a far better arrangement for everyone. Unless he is a disgrace to the company and the community, the company should not interfere in his personal life.

We cannot make hard and fast rules on this because employees who do not behave properly outside of the plant cast a reflection upon the company. In such instances it is usually better to release the employee. Tact is required, for these individuals can certainly become troublemakers. Here is where it takes the skill of a good industrial relations man to smooth out the problem.

If company picnics are to be the vogue, don't make them compulsory. Just watch to see who shows up and decide if it is worth while. Better far to keep harmony and "free employees" than to run a slave ring and have an undercurrent of dissension within the plant.

Charles D Townsend
West Hartford, Conn

A PLANT PICNIC to be successful as a morale-builder should be part of the company's recreation program. Operationally speaking, company recreation programs are a form of maintenance for the human resources of the company. They are also an aid to industrial relations and an adjunct to public relations, both of which pay handsome dividends at the community level. In view of the benefits to be derived from an outing for the working force, it is believed that a company-sponsored picnic would eliminate unfortunate cliques and personal animosities engendered by an affair run by a group of individual em-

"OK so machines can't think. That still doesn't give me any advantage."

ABC...and the Reader

BACK IN 1914—forty-one years ago—a group of advertisers, advertising agencies and publishers joined in a project that has come to mean a great deal to the millions who, like you, read business magazines. The project, initiated at a time when circulation claims were rarely verified, was intended to achieve and maintain higher standards of integrity in publishing and advertising practice by providing means to audit paid circulation. Out of that effort came an organization known as the Audit Bureau of Circulations, a voluntary, non-profit, cooperative association, known for short as ABC. Its symbol appears at the head of this page.

We are proud that McGraw-Hill publications were among the founders and charter members of the Audit Bureau of Circulations.

Today the Bureau numbers 3,670 members. These include advertisers, agencies, and publishers of newspapers, farm papers, general magazines and business journals such as this one. These publisher members hold their memberships and their right to display the ABC symbol in their publications only so long as they live up to the circulation standards that are established through the Bureau.

It is one thing to set up high standards; it is another to see that those standards are maintained. This latter and all-important function is performed by a staff of auditors maintained by ABC to check periodically on the circulation practices of the publisher members. When a business magazine, such as this one, joins the Bureau it agrees that the ABC auditors shall have "the right of access to all books and records." Their inspection may dig into the files of original subscription orders, payments from subscribers, paper purchases, postal receipts, arrears of payments, editorial expenses and many other significant items. Sometimes the auditors go behind the records and seek verification of purchase and payment from subscribers themselves.

The information thus obtained and certified by the Bureau then becomes available to the public and constitutes an authoritative report on the publication's circulation practices.

The advertisers and agencies benefit directly from the ABC because it provides a generally recognized factual yardstick by which the circulations of member publications can be measured and appraised. Every paragraph in an ABC report on a business publication gives the advertisers data that help them make intelligent use of the publication as an advertising medium.

But the ABC renders a service of vital concern to the *reader* as well. The Bureau audits paid circulation only, and it is through this payment, whether by subscription or newsstand purchase, that the reader keeps the editorial policy of a publication responsive to his needs. His decision to buy or not to buy records his judgment on each publication, and the ABC-audited and certified circulation reports make the sum of these judgments known to all concerned.

So the editors of ABC publications must constantly keep their editorial services up to the mark if they are to survive a competition in which the reader's right to buy or not to buy is paramount. Each paid magazine or newspaper will prosper or fail as it wins or loses the voluntary patronage of thousands or millions of readers. And—the ABC is scorekeeper in this vital contest.

Thus the publisher who submits his publication to the supervision and discipline of ABC affirms in the strongest possible manner his recognition that his primary obligation is to his readers and that he owes the standing of his publication to a voluntary demand by those readers.

All this is what makes the ABC brand on a publication so important to its readers. That respected symbol, testifying to the advertising value of the publication, serves also as a constant reminder to all concerned that the reader's willingness to pay for an ABC publication is the basic reason why it stays in business.

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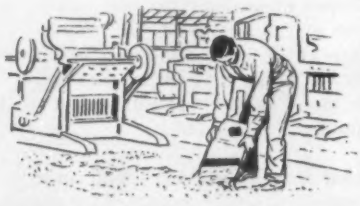

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ployees who would inevitably limit invitations to their friends.

Practically speaking, the type and scope of an outing depends on the size of the plant. Recreation programs which include picnics range from the highly informal variety, usually found in small plants where the employees know each other intimately, to those operated by large companies whose working force would populate a medium-sized town. From my experience with recreation programs and plant picnics, I have found that in the smaller companies, direction of the program is often in the hands of the employees, and they are responsible for its success or failure. But in the large companies, there is usually a part-time recreation director who acts as coordinator and advisor and keeps the program running smoothly. The big company needs a formalized program more than the small plant. It will also be found in some companies that a member of the industrial relations or personnel department usually serves as a part-time director of the recreation program. Again, in some plants, employees' associations and groups often help plan and administer the program.

In my opinion, being aware of the frailties of human nature, it would be better if the managements, both of small as well as large plants, made the affair an official company outing. In this manner, every employee goes, and nobody gets hurt feelings. Contrary to the anguished cries of paternalism and regimentation that may fill the Spring air, picnics should be part of the com-

"But, boss, at the New Year's Eve party last night I was your best friend and your most trusted and deserving employee!"

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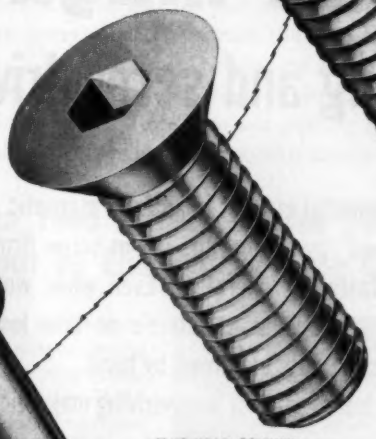
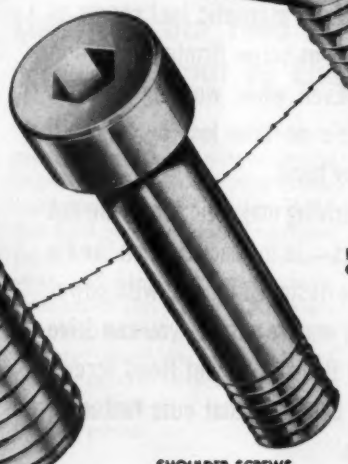
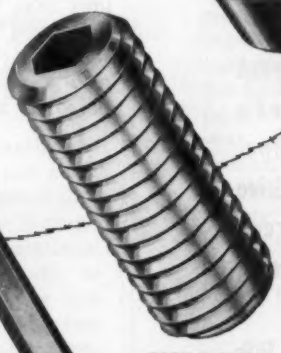


FLAT HEAD SOCKET CAP SCREWS



SHOULDER SCREWS



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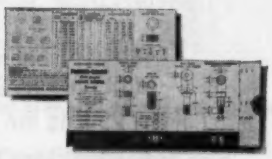

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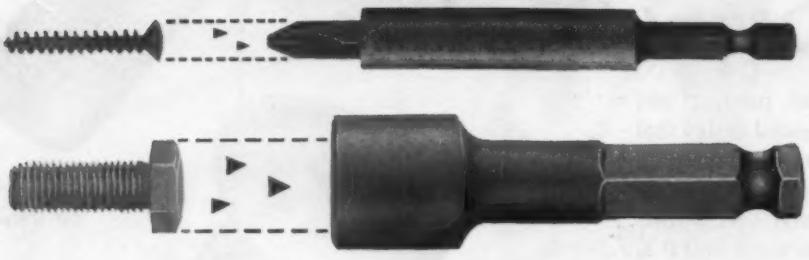

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pany recreation program and not left to clicque-building groups.

An outing to serve as a good morale-builder should be free from bias and exclusiveness. When it is company-sponsored all employees are welcome and employee attitude is one of happy anticipation, and not concern and apprehension as to whether or not an invitation will be forthcoming. A successful outing repays the company well in increased loyalty and the feeling of identification which the workers develop with the company.

When every worker is offered the opportunity to get together on his off-hours with his fellow employees a fortunate frame of mind is established that is conducive to cooperation with his fellow workers during work hours and to the company that made the affair possible and unrestricted. A plant picnic is an intimate means of communication between management and the worker and his family. A company outing takes the company with it. It may even bring about dinner table discussion in the days prior to the outing, and that's to the good. Moreover, when the picnic is open to all it helps generate better social and company relations through stimulating good fellowship and promoting good will. Any activity that concerns employees, their jobs, and attitudes toward the company is worth the sincere and enthusiastic efforts of management and the willingness to devote time and effort in making that activity successful. A company-sponsored picnic will get across the idea that the company is sincerely interested in the employee's welfare. It is a harbinger of good will. It is also a friendly reminder that the personal and off-hours side of the

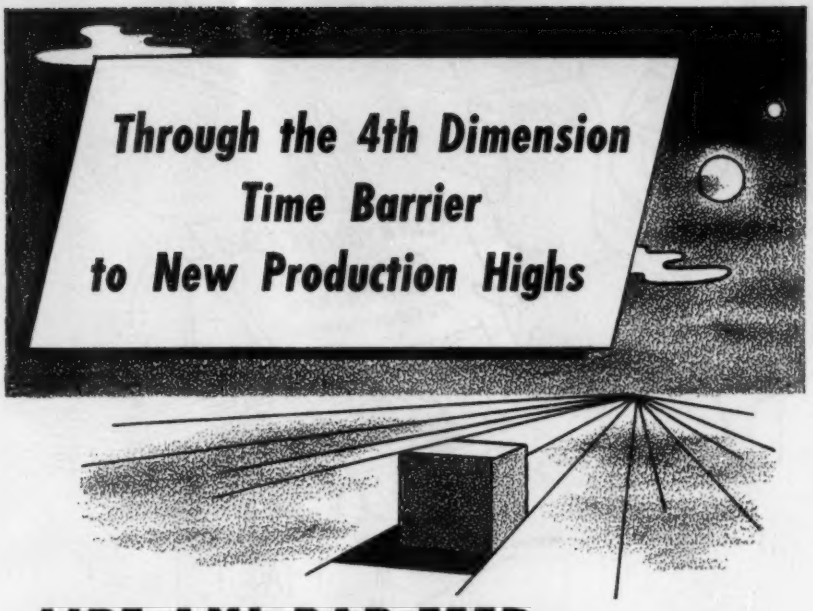
worker's life is of interest to a company concerned with the well-being of its employees. The company outing is a natural in reaching workers with the company side of the story when management has a message to get across and employee cooperation is necessary.

Attendance at a company picnic need not be obligatory for every worker. But there is this advantage of a company outing over an individually sponsored effort: the company plan creates a spirit and sense of one big family, whereas individual plans tend to prevent the emergence of group spirit. A picnic planned by an exclusive set of workers will undoubtedly degenerate into a "cliqnic." This is hardly the right way to maintain cooperative relations between workers. Management owes it to its employees to make recreational activities available to all workers even at the risk of offending the cliques who would have you believe that a company outing is mixing personal life and work life together; an unhealthy situation according to their misguided reasoning.

Harry Kaufman
Philadelphia, Pa

AL HAS a good idea in promoting a company picnic and is heading in the right direction for improving the morale. The employees are more than machines, they are social beings and require more than lubricating oil and the torque of a drive motor to keep them running. A shop cannot function without cooperation although it is sometimes erroneously believed that orders and instructions if firm and complete are all that is required.

The company is in operation to show a profit and should not overlook any opportunity to increase production. In their struggle through the great myriad of operations, drilling, turning grindings, etc, to find ways of cutting costs, they lose sight of some of the big overall factors which affect every operation. Working on these details, like getting the best angle on a particular tool, is similar to working in a forest—you cannot see very far. It is very true these details are important in controlling costs but the big things should not be lost sight of. There is no doubt that the happy worker is the good producer. The happy worker is a cooperative worker and a safe worker. A man spends eight hours a day in the shop and maybe more, forty or more hours per week



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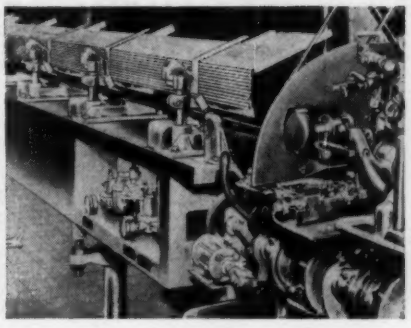
Time losses account for the enormous differences in output among workmen. By eliminating these losses automatically, the Lipe AML Bar Feed boosts overall production from 30% to 100%. That's because stock is fed to the machine independent of the operator. Constant pressure behind the stock assures uniform speed of feed. No feed fingers to fail or mar stock. No multiple feed-outs, even on the longest pieces.



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1-TON	$ 552
2-TON	$ 627
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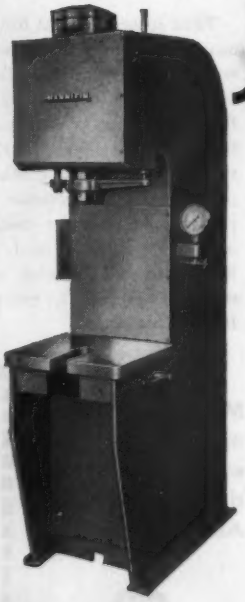
Prices complete with motors and starters F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.



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out of one hundred and sixty eight. Approximately ¼ of his time, ¼ of his life, is spent in the shop. What with overtime and Saturday work some men see more of the man at the next bench than they do of their children. The company should make every effort to make the shop a pleasant place to work, for it is to their advantage.

Company picnics are one way of promoting this friendly cooperative spirit. Of course it takes more than a picnic once a year, but it is a good start toward developing the right spirit in the shop.

Ling Yen
Brooklyn, N Y

I DON'T THINK that a general statement of the effectiveness or non-effectiveness of such things as shop picnics is applicable to the average shop. There are such a wide range of circumstances to be considered: the large shop, where the workers seldom, if ever, come in contact with each other, cannot be compared with the small one where the fellows are intimately acquainted. We naturally have the extremes in everything so it remains to be seen where a shop picnic would fit in to the best advantage.

From my viewpoint the idea behind such things as picnics seems to have arisen from the annual gatherings held back in the latter years of the past century when the Sunday Schools had their annual gatherings in the refreshing woods. For nothing more than selfish reasons I participated in a few of them, after attending classes a couple of Sundays prior, in order to make myself eligible, and you can bet your

"You sure made me look like a dope in front of the boss today! Why didn't you tell me I got a raise three weeks ago!"

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Outstanding . . .

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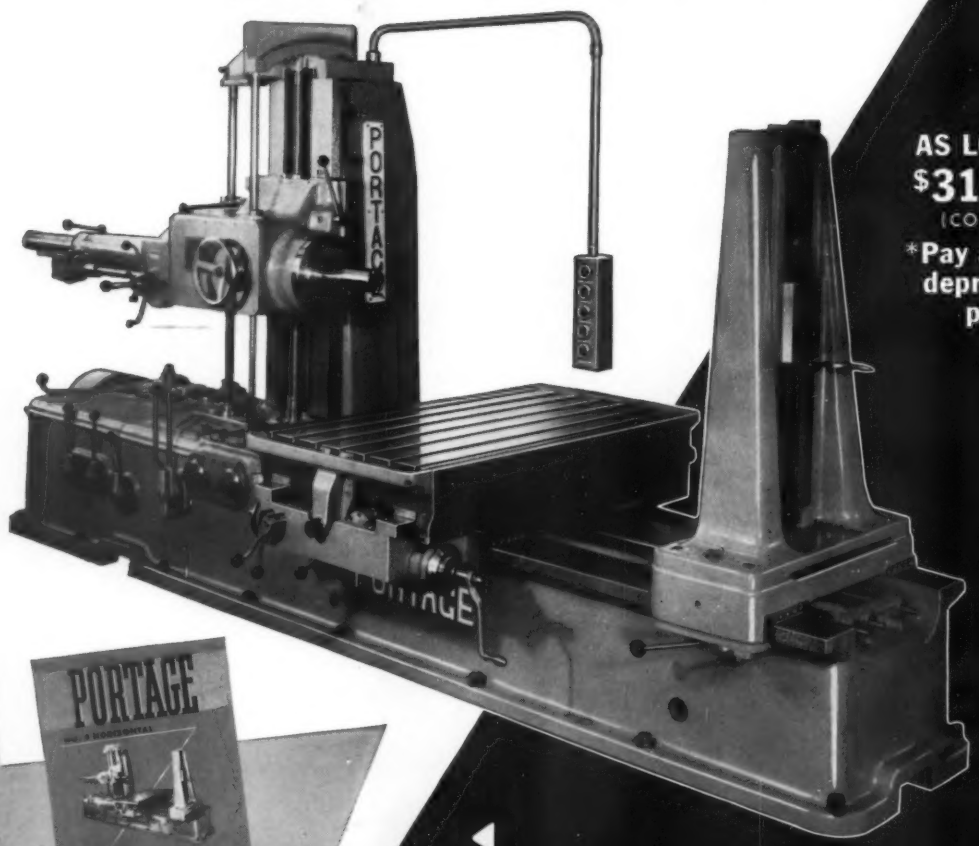

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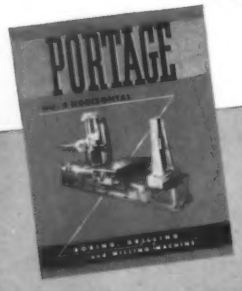

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*** For full particulars, phone the factory today!**

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life that I didn't show up for about fifty Sundays to listen to the boring details of the Old Testament.

The thought comes to me that shop picnics could not very well be conducted in such militaristic fashion as was our goody-boy picnics of the Nineties for the simple reason that workers do not like to be regimented as were the kids of yore.

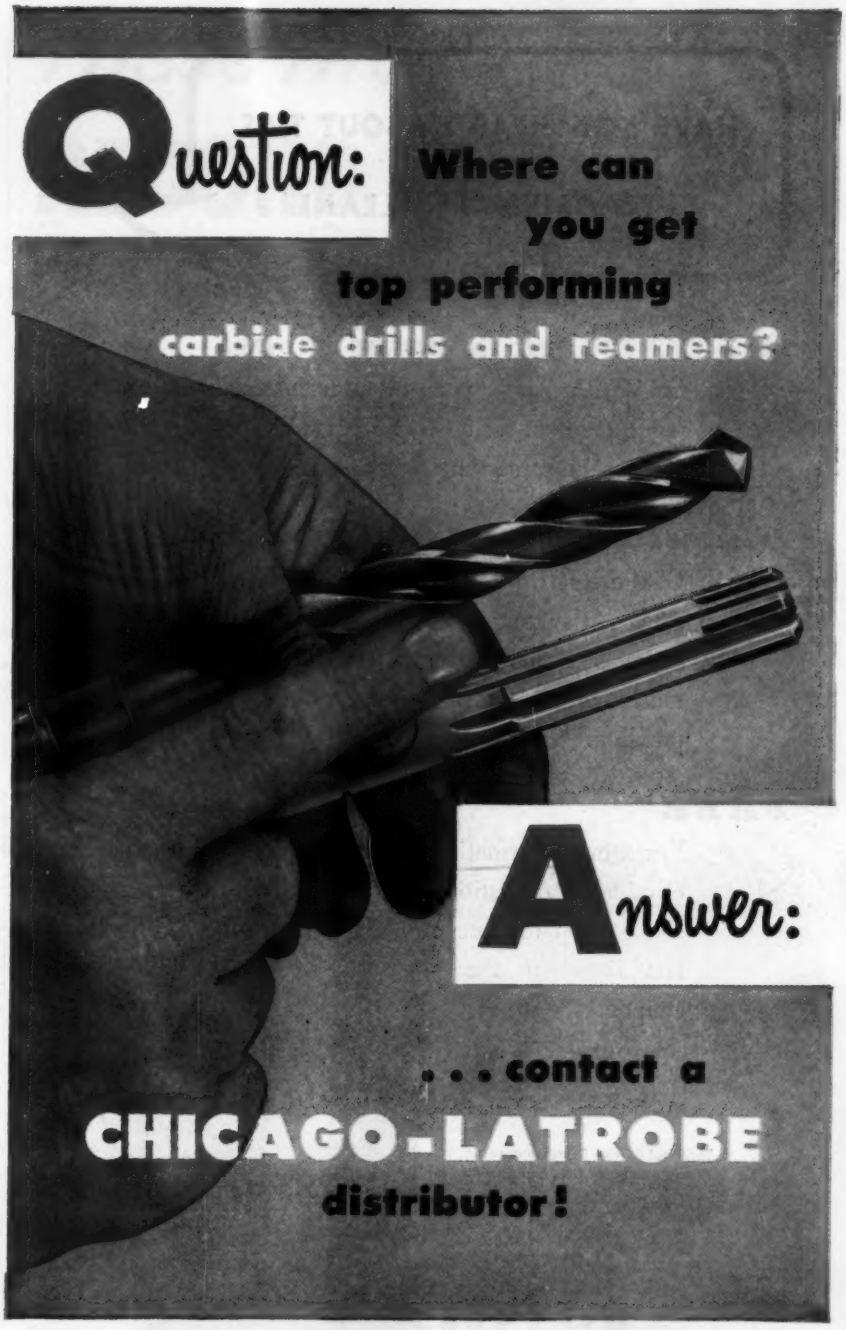
Regardless as to how the work-weary boys would get to the picnic grounds, I'd start out the festivities with a long monotonous speech given by one of the big wheels preceding the gastronomical bargain counter in which he would extol the workers for their efforts during the preceding year. This would whet the appetites prior to the slurps and gulps as well as to get the wind out of the big-shot's sails. Interspersed with the ungodly yakking and plate crashing I would have the Ed's and Al's of factory fame enter into a lengthy debate on the ethics of rest room technique during working hours. In as much as there are many who are inclined to sleep on the job following lunch, I'd like to see a siesta hour following the gastric marathon so as to enable the over-stuffed celebrators to become normalized before taking on the contents of the barrels. Following several fist fights and family feuds in which uneaten cole slaw and potato salad augment heated words, the merry makers participate in a fender smashing session on their way home.

There is no use in having a picnic just for the purpose of having a good time; the idea is to have it create something of lasting benefit to the employees and the employer. It is a foregone conclusion that there will be a couple of sore heads following a gathering of this kind which may offset the benefits derived otherwise. However, I don't feel that this outweighs the good fellowship created by the gathering at a session where everyone can let down his hair, so to speak, and have a rousing good time.

Robert Roundbottom
Laguna Beach, Calif

IT IS basically wrong for the company to run a picnic if it is intended to serve any purpose except the pleasure and enjoyment of the employees.

If they do have the picnic it is important that management avoid the appearance of paternalism, of granting something out of the goodness of their hearts. What is done must be done as a matter of right



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Oakite Rustripper is an alkaline material that strips paint, pigment residues and phosphate coatings from steel at the same time that it removes rust and oil.

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and justice, not as a favor or a charity. Many a program of employee-benefits has been wrecked by this error. Workers have been presented with costly gifts, such as club rooms, bowling alleys, and swimming pools, etc. and have refused to enter the doors. Gifts, no matter how large, do not take the place of the smaller items of genuine consideration.

As a general thing Ed is right in his recognition of the true situation, and in his efforts to keep off-the-job activities separate from shop duties. The men see and hear enough of the company and the company rules. If they want a picnic, let them run their own; they will have more enthusiasm and enjoy it lots more.

William Sincowski
Woodside, NY

AL'S IDEA of having a spring picnic to which all the men in the plant and their wives and families could be asked, is somewhat dated. Gone are the days which favored the one big happy family idea in industry. Bounding prosperity in America would seem to have killed the idea over there and the disease has now spread to Britain.

Full employment and high wages don't necessarily spell happiness or contentment, nor do they promote feelings of good fellowship among the various grades throughout shop personnel, not to mention the wives and perhaps grown-up families. This is specially noticeable in the large, prosperous corporations to which we, on both sides of the

"Calm down, Bill; it wasn't some mad monster from outer space . . . it was just a bug on your safety goggles!"

Atlantic, are accustomed today. In large plants with wide ramifications there are so many "plum" jobs carrying high salaries and considerable power; and just as opportunities have multiplied, so have human desires and jealousies.

I am convinced Ed is right in preferring to keep work hours and "off hours" separate. It is no part of a foreman's job to organize the workers' "off hours." If he can organize their work hours to his own satisfaction, to the satisfaction of his boss and to the satisfaction of the men, he will be doing just what he's paid to do and will have done a very fine piece of work indeed. Shop picnics are very much on the way out. They were gala days to a former generation to whom outings were something of an event. Today, however, when most employees own a car of sorts, picnic outings have become commonplace and they prefer to picnic en famille, choosing their own time and place rather than be one of a crowd for whom a place and date are chosen.

Now that people have become more mobile they have become less gregarious. The herd instinct no longer applies to the workers' picnics; it is now reserved for the movies, football, baseball, coronations, tube stations and the like. TV also tends to make its devotees more insular.

A shop picnic would undoubtedly be good for company morale, provided the right spirit did prevail. If everyone went to the outing determined to enjoy the event and forget all about work and "standing" and "precedence," the day out together would have a tonic effect on all concerned. That, however, is just what seldom happens. Some would be there because they felt being there was, if not a must, at least expected of them. They would probably not enjoy the experience and would not be likely to help others to do so, either. It is a safe guess that many more would have other fish to fry on that particular day and, as a consequence, would not feel they were making the best use of their hours off. In the circumstances, company morale would not benefit.

If the employees keenly wanted a picnic, they could be trusted to set the ball rolling in that direction, themselves. The fact that the suggestion comes from the shop foreman would seem to indicate that picnics do not interest the rank and file very much. Perhaps recent revelations concerning the chit chat of the bridge club was in Ed's mind

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"BLU-MOL"® HIGH-SPEED POWER BLADE

No wonder this spectacular performer is considered by many production men to be the greatest all-purpose hack saw blade ever developed! It can save 20% to 50% on sawing costs!

"JET-EDGE"® HIGH-SPEED WELDED-EDGE POWER BLADE

The famous "Jet-Edge" high-speed cutting edge, electrically welded to a tough alloy back, provides tremendous cutting power in a blade that is practically unbreakable even under toughest usage.

Outstanding Performers . . .

In plant after plant these phenomenal Millers Falls Saws have earned a place – set production records on the toughest kind of jobs. Compare them with the saws you are now using, and you'll see why Millers Falls better design, finer steel and more effective heat treating methods pay off in greater cutting power. "Blu-Mol" and "Jet-Edge" are part of the world's most complete and highly developed line of hand and power hack saw blades, hole saws and metalcutting band saws. Write today for a demonstration. No obligation, of course.

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MILLERS FALLS COMPANY
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SINCE 1868

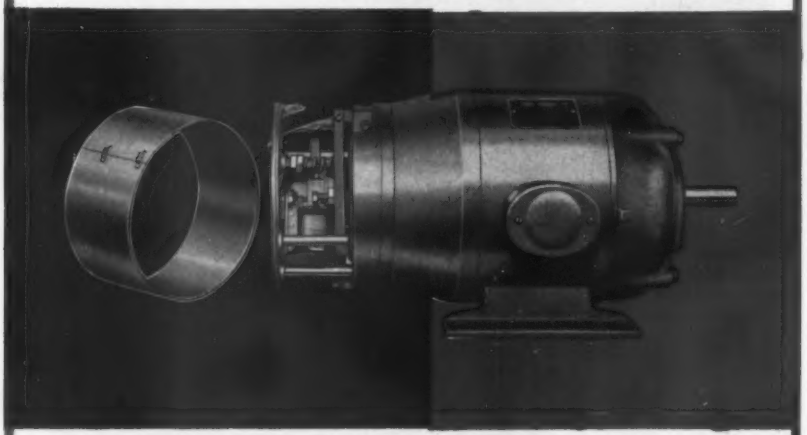
to ***MACHINE DESIGNERS, Howell suggests***

What to look for in Brake Motors

Long-life braking action Durability in the brake means less maintenance on your machines. Howell's super tough friction disc is spline-mounted for extra strength. Push rod and rocker arm slots are heat treated to file hardness (60 Rockwell C).

Fail-safe operation protects machine and product in emergencies. In case of power failure, the Howell brake sets automatically. Brake is also equipped with hand-operated lever to permit manual braking.

Accessibility and Compactness The Howell brake has a wrap-around cover that removes in seconds for quick easy brake adjustment. Because cover removal requires no end clearance, the Howell brake takes up minimum space.



NEMA - Standard motors give machine builders and users complete motor interchangeability, help them reduce inventories and simplify purchasing. Howell gearmotors give you this valuable feature — with the new re-rated motors included!

Fully-protected bearings insure longer motor life. Dirt can't enter Howell's double-shielded bearings either from inside or outside the motor, because they are sealed in the end-plate cavities by dust-tight inner caps.

Copper-clad rotors mean better heat conductivity, stability at high temperatures and, as opposed to die-cast rotors, greater design flexibility to meet your particular motor requirements. All Howell motors have them.

Howell brakes are torque rated for up to 50 lb. ft. for continuous duty; up to 75 lb. ft. for intermittent duty.
Shown left are two of many possible mechanical variations: a vertical C-face mounting and a unit incorporating the super-compact Howell disc motor.

WRITE FOR BULLETIN BR-2

HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.
Precision-built motors for industry since 1915

HOWELL Red Band MOTORS

when he vetoed the picnic suggestion?

Another reason why factory picnics are not all round, hot favorites is that they are essentially strenuous outings involving games — football, running, jumping, cricket, tug-of-war, to mention a few, and if they are family outings, the young fry must not be left out. Swings, races and ball games must be arranged for them. All that exertion is intended for youth; but all factory employees are not young and the not-so-young must be keenly interested in helping youth to enjoyment, or must suffer an afternoon of boredom for themselves.

How much easier for the not-so-young to remain at home and, in the evening, switch on their TV, settle into a comfortable chair, and be entertained without perspiring? I don't defend that attitude, but for the older men, I realize its attraction. Thus, the shop picnic would not realize, in its entirety, Al's ambition of getting all together to know each other better; if only the young and active put in an appearance. On the whole, I agree with Ed and his realism in this matter. The men in the shops have ample opportunity to get to know each other.

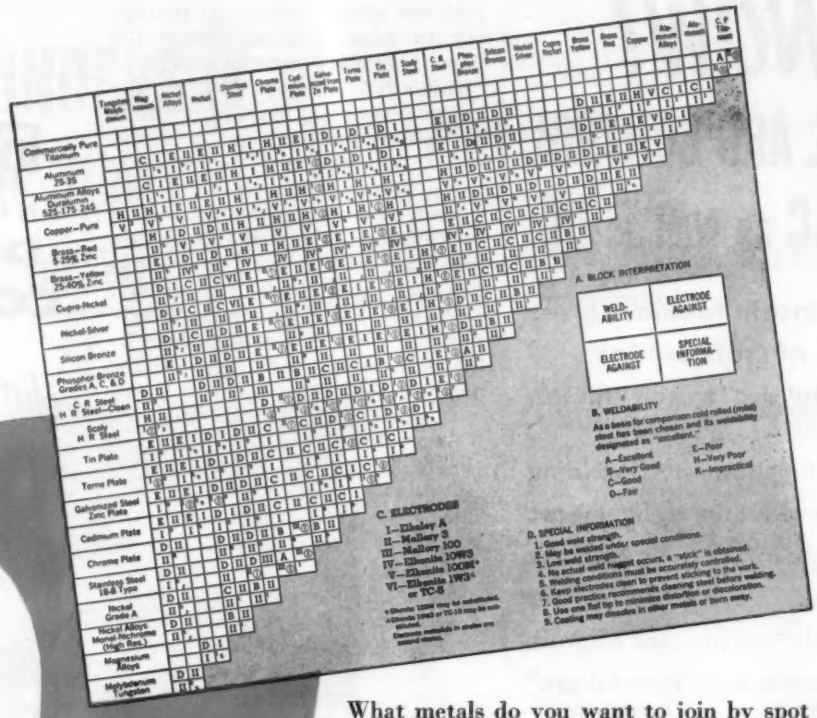
C Donald
Lanarkshire, Scotland

WHIPLASH

Will the shop men tend to work harder or faster if they are aware that the foreman is making notes on their work habits? Or will they grow resentful at his apparent lack of faith in them?

HAVING READ YOUR PUBLICATION of April 11th, I was favorably impressed

". . . and I think the greatest improvement you could possibly make would be to bank the corners that lead to the time clocks."



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Are you using the right electrode alloy

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- The recommended Mallory alloys to use as electrodes against each metal.
- The weldability you can expect.
- Special information on welding techniques to be followed.

This "electrode recommendation chart" is just one of the many useful features you will find in the Mallory Welding Catalog. Described in this publication are the unequalled variety of welding alloys which Mallory has developed to meet every welding requirement . . . to provide the best combinations of conductivity, hardness, strength and wear resistance in hundreds of different designs. Mallory electrodes, holders, seam welding wheels, forgings, castings and dies are listed, for your convenience in planning effective and economical welding set-ups.

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Idealarc can be purchased to furnish both AC and DC welding current. It can be bought as a straight AC welder to which a unit can be added at any time to furnish DC current as well as AC.

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with the several comments pertaining to labor relations, especially those items and comments under title "Whiplash."

The department head, in my humble opinion, holds the key to the success or failure of the modern plant today. He must be a leader of men, express devotion and enthusiasm for his company, and at the same time generate characteristics which cause those who work under him to have confidence, respect, and even friendship for him. This can be done by the positive approach method. The negative approach could precipitate misunderstanding and difficulty.

After 13 years in departmental employment I feel the average worker seeks fundamentally:

1—Security for himself and his family.

2—He must feel important to his company by being made to feel important by his supervisor. This can be achieved by the supervisor asking favors and opinions of the workers, by complimentary remarks and appreciation of a job well done stated verbally to a worker so involved. A compliment given at the proper time will stimulate the best performance from the worker. This is effective, however, after good will and friendship has been established.

In short, since we are all human beings, and are subject to error and mistakes, an attitude of proper fraternization seasoned with understanding and sympathy must persist at all times with emphasis placed on the

(Continued on page 248)

"I don't like my trouble signal—"

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UNITIZED DUST CONTROL
eliminates dust at its source!

TORIT UNITIZED DUST CONTROL means each machine has its own custom-tailored dust collector designed to work specifically for *that* machine. There is no guess work, or average suction. Furthermore, dust control is provided only when that machine is running . . . there is no waste of power such as you have with centralized control when only a few machines are operating. This means better dust control at lesser operating cost and less initial installation cost. Get the facts now on how Torit will work better to . . . "CLEAR THE AIR".

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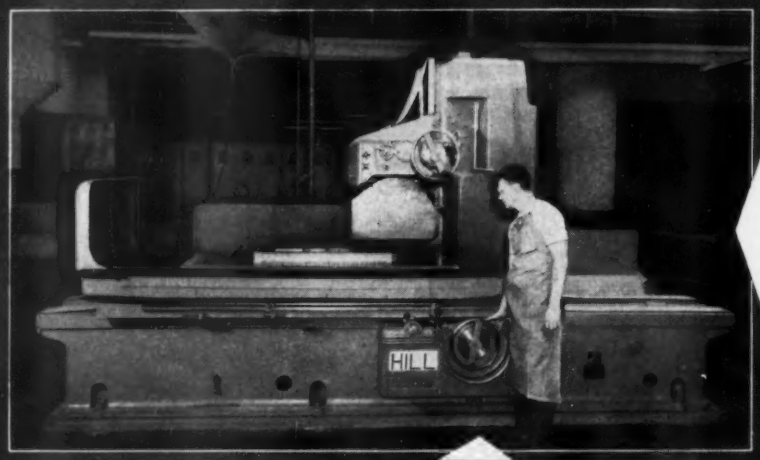

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- **Built in both Horizontal Spindle and Vertical Spindle types.**
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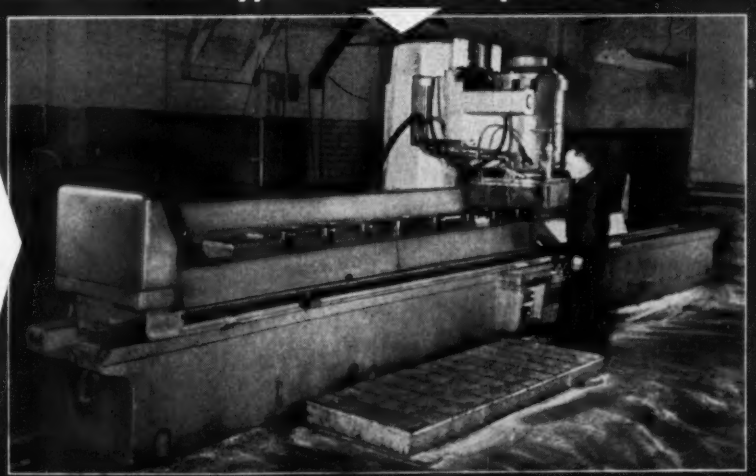
Use the "Hill" Vertical Spindle Grinder for rapid stock removal and accurate grinding of flat surfaces — recommended for accuracy, speed and finish — features that mean increased precision production. Made in table widths of 18", 24" and 30" — table lengths from 5 to 20 feet.



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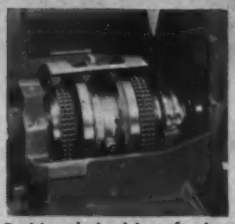

Positive chain drive of spindle at all speeds assures full power for all operations within tool capacity of machine.

Desired high speeds are quickly selected using one set of pick-off gears in this base compartment. Corresponding ratio and direction for low speeds are selected in same simple manner.

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Exclusive Combination of Productive Features

- 196 two-speed spindle combinations ample high/low speed ratios
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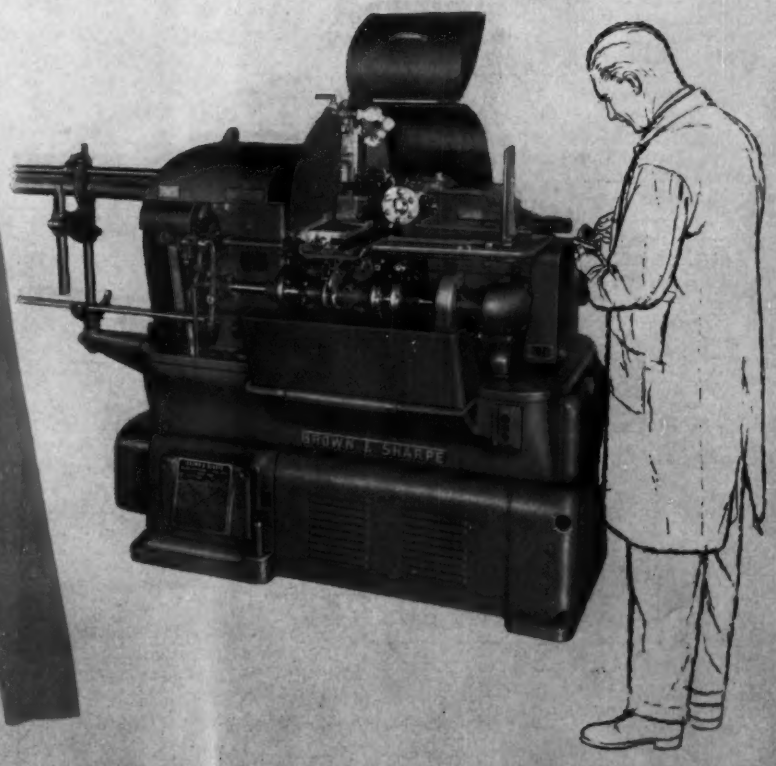

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I'VE SEEN THEM COME — and I've seen them go,
Lathe hands fast, as well as slow,
Tall ones, small ones, thin and stout,
Some who had nothing to brag about;
Guys who only had sheer brute strength,
Fellows so clever they'd split a tenth.
All these I've seen, down through the years.
Some I have parted with, almost with tears,
Sad ones, funny ones, who'd keep you in stitches,
Stool warmers who wore out the seat of their britches.
From carbon tools to hss and then to Carboloy.
I've seen them make production grow to man from boy.
Now, the "bull" wants someone different,
Says a lathe hand knows too much,
Hasn't got the fancy footwork, and seems to lack the touch,
Has no flair for pushing buttons with a single-minded stare,
Sure, and as for snapping switches, 'tis more than he could bear.
So I'd like to take old Al with me, and make the rounds some night,
To a certain bistro near the shop, that he might see the light.
No, it's not known as "Hernando's" and it doesn't touch the "Stork,"
Its clientele consists of guys who use their hands for work.
We could sit down at a table, and enjoy our favored brew,
I'd introduce him all around—he might meet some boys he knew,
Who "knew him when" he ran a lathe and wasn't prim or proper,
He could feed his latest brainwave in the conversation's hopper.
Then, I'd sit back and enjoy it — watch the verbal cannons roar,
As a "special-purpose unit," maybe pick Al up off the floor.
Yes, the man is still important, with all his myriad faults,
And with him progress staggers on, through many creaks and halts,
This new-type operator, this button-pushing boy,
May herald the milennium, and automation's joy;
As for me I'll still keep plugging, with the men we now employ!

"Mike Calipero"
Glastonbury, Conn

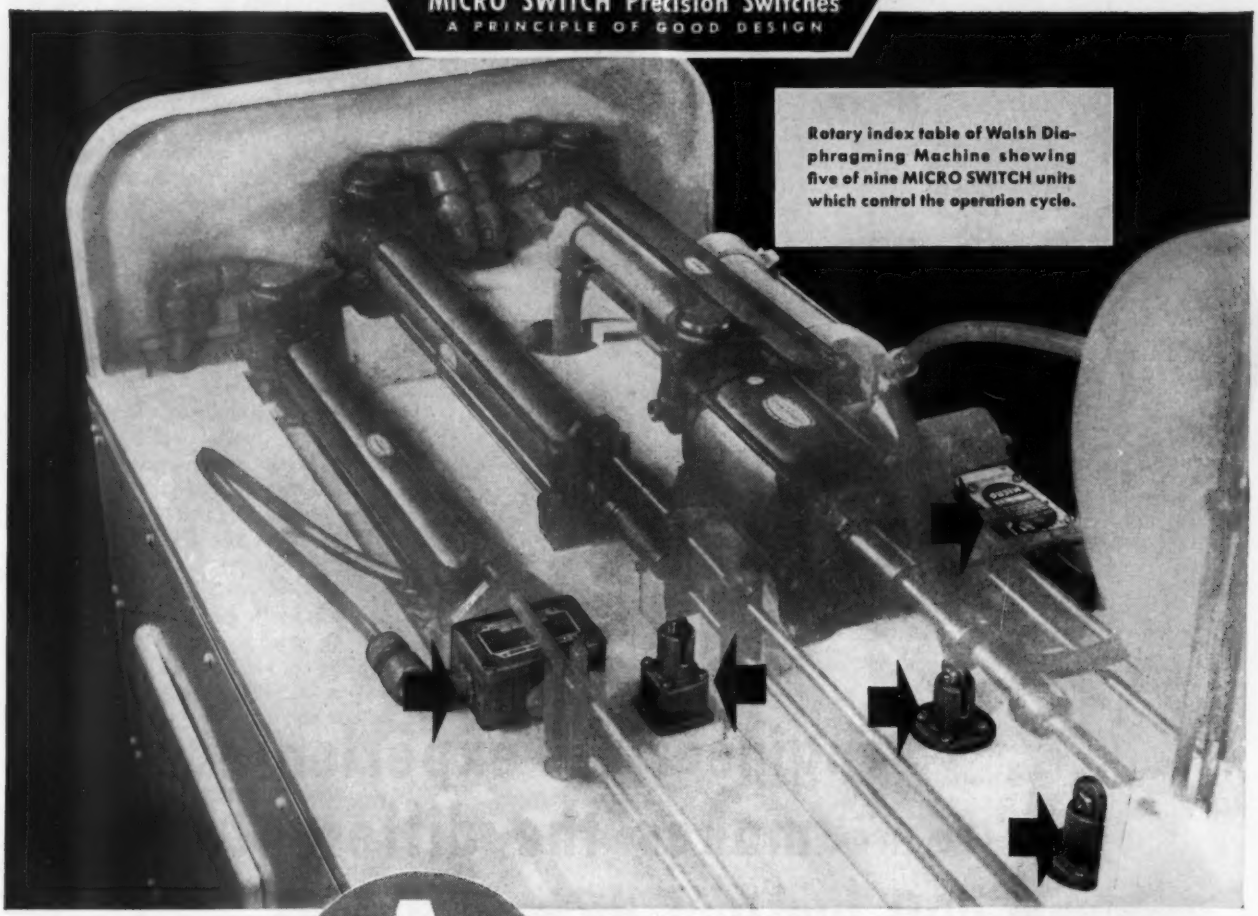
"The foreman liked the way ya' told me to speak up for a raise . . . ya' start working my milling machine tomorrow morning!"

BACK IN THE HURDY-THIRTIES there was a lot of talk about machines replacing men. The soap-box orators were shouting about the rising unemployment and blamed the new machines for putting men out of jobs. Today there are a thousand times as many machines which make the other machines look sick, yet the employment figure is at its highest. This is progress.

The machines today are even more automatic but still require operators. These new operators are not skilled in the sense that skill was known to us yesterday, but there is a certain something that a man or woman must have to operate the new machines. There are millions of automobile drivers on the roads today, but they all drive differently. If they all had the same kind of car, and were all taught by the same instructor, they would still drive differently.

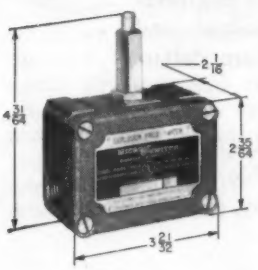
The reason for this variance is the human element. As long as a machine requires a human being to operate it, it will respond differently to each person. These operators will have to be taught the proper technique in pushing buttons. The women

MICRO SWITCH Precision Switches
A PRINCIPLE OF GOOD DESIGN



Rotary index table of Walsh Diaphragming Machine showing five of nine MICRO SWITCH units which control the operation cycle.

Artillery Shell Primers made automatically—with help of MICRO SWITCH explosion-proof switches



Explosion-proof switch with pin plunger actuator

Heavy duty explosion-proof limit switch with roller plunger actuator

Use of nine MICRO SWITCH explosion-proof switches in this Walsh Diaphragming Machine is a typical example of the use of these versatile switches in the development of automatic machinery.

In one stream-lined operation, the MICRO SWITCH units eliminate all hand work as the machine lacquers the interior of the primer body; punches and forms diaphragms from a paper roll; seats them to proper depth and provides final inspection.

Designed by Walsh, Inc., Chicago engineering firm, the machine is used at government installations to prepare primers for artillery shells. All the operations are performed in an explosive lacquer-laden atmosphere. Nine MICRO SWITCH explosion-proof switches, of two different types, control the operation cycle.

Whatever your design problem, whatever your switch requirement, your design staff will find MICRO SWITCH engineering service a valuable ally. There are branches in 20 key cities. Call the one nearest you.

A complete line of snap-action and mercury switches

MICRO SWITCH provides a complete line of extremely reliable, small-size, high-capacity, snap-action precision switches and mercury switches. Available in a wide variety of sizes, shapes, weights, actuators and electrical characteristics. For all types of electrical controls.

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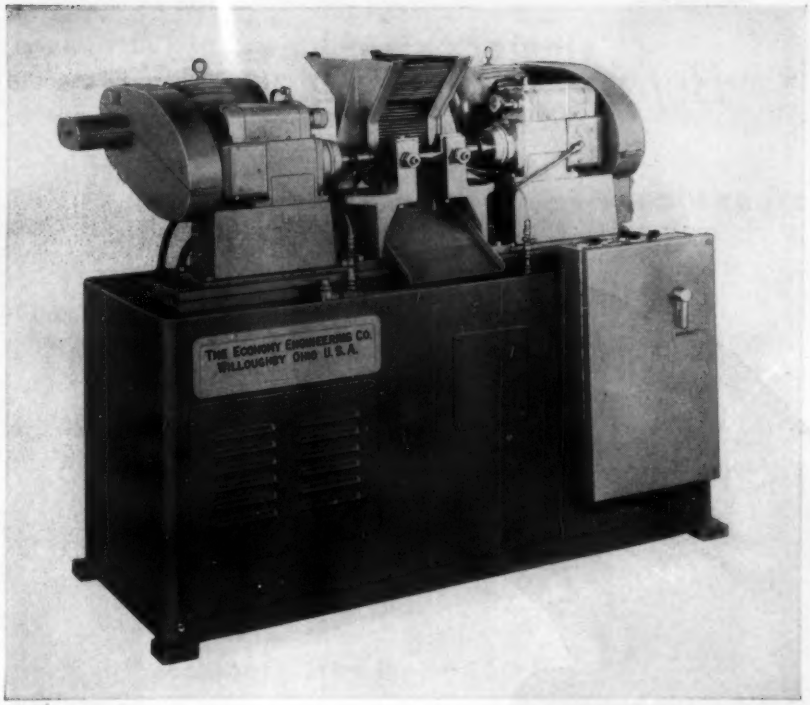
will have the edge on the men since they were the first to adopt the automatic transmission, the pop-up toaster, the automatic washing machine, and many oher household appliances. The men have shied away from the automation era except to talk about it. The pushbutton operator is finally here, and here to stay.

Frank J Zarnowski
Rutherford, NJ

THE AUTOMATIC MACHINE that can produce parts with the pushing of a button is not something to be frowned upon. It gives us more production with less effort, something we have always regarded as desirable. Everything in this world which man possesses has been produced from man's efforts and the raw materials of nature. Even a material as elementary as the coal or wood we burn in our stoves required the expenditure of human effort, or the coal would still be in the ground and the tree would still be in the forest. Anything that we can do to reduce the human effort required for production means we can produce that much more. Because of the complexity of our society we sometimes lose sight of the basic truth that as a group we only possess that which we have produced; to have more we must produce more.

Productivity is simply the rate at which we convert human effort and the raw materials of nature into useful products and services. Productivity is not the same thing as production. We can increase our output by working longer; this increases our production but not our productivity. On the other hand, if



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Economy Engineering Co., Willoughby, Ohio employs two Hartford Drill Units on their standard hopper fed double end machines to taper ream 60 valve push rod tubes per minute to close tolerances.

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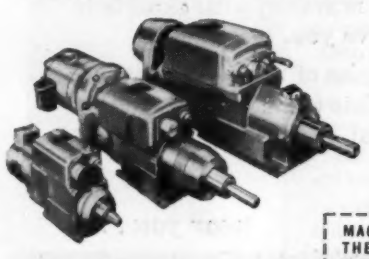
*Formerly produced under the trademark "Delta-Milwaukee" by the Rockwell Mfg. Company



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a new machine or an improved plant layout results in increased output with the same or less expenditure of human time and effort, productivity has been increased.

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Our standards of living will continue to rise as long as we continue to use our hands and minds to discover and develop and apply new and better methods of production.

Henry George
Bronx, NY

ONE THING Ed and Al seem to have neglected. What they have failed to take into consideration is that a new machine cannot be justifiably appraised in its performance by the results accomplished in a short workout. I've been on hand when a first-class machine, the reputation of which was well established in high

"For people who can't make up their minds what setting they want."

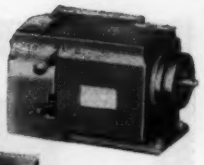
brackets over a period of years, has received a black eye, so to speak, by unfair people who sought to ascertain the machine's peak performance with an operator who, if given more time to get the feel of it, would have certainly acquainted himself with its most effective workings. You can't bring in a new piece of equipment and have it register effectively right off the bat—it takes time in order to obtain the best result.

Regardless of the efficiency of a machine, if you don't have an operator of equal effectiveness you won't get the peak results. Likewise, if an A‡1 operator is put on a machine that can't take it, he is held back in his efforts. And don't be fooled into expecting subsequent workers to perform with equal facility, as it may be that the first one selected was a find of rare quality and cannot be easily duplicated. Looks to me as if the man from the shipping room who showed up with such good results was one of these rareties one discovers only occasionally.

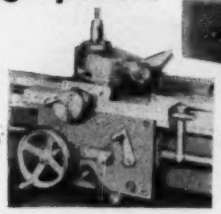
Old Bill Pressfit, a first-class machinist if there ever was one, was put on a production lathe as an emergency shift and the guy turned out to be a complete flop as a producer. There was no doubt in anybody's mind about Bill's ability as a mechanic. He was unexcelled as a lathe hand, and could adapt himself to any job he was put on, but when they tried him out on "production" in the commonly understood sense of the term he proved to be a complete failure. Why was this? One of Bill's friends confided in him that he was a great disappointment to the foreman and Bill just shrugged. Old Bill smiled as he placed his hand on the other's shoulder. "Maybe I could have done better if I had a mind to, but if they think they're going to make a machine out of me they're badly mistaken. I didn't want that monotonous job, and I sure as hell made it my business to let them know that I was not the man for it. Any time they put me on something where I can't use my brains one of my glands gives out and I can't produce."

An experienced man has some sense of honor about the kind of work he is to do, and to put him into a position wherein he has to function with monotonous, perfunctory effort is only inviting him to commit psychological sabotage—not doing his damndest to perform to the highest peak of his ability. Whereas when you put an inexperienced man on a new machine, designed primarily to turn out work of a dupli-

from its big ball bearing spindle



to the precision carriage



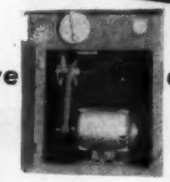
along its

rugged, accurate bed

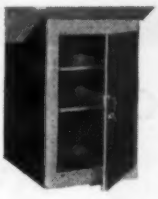
to the tailstock

and down to the variable

speed drive



and its solid, strong, convenient



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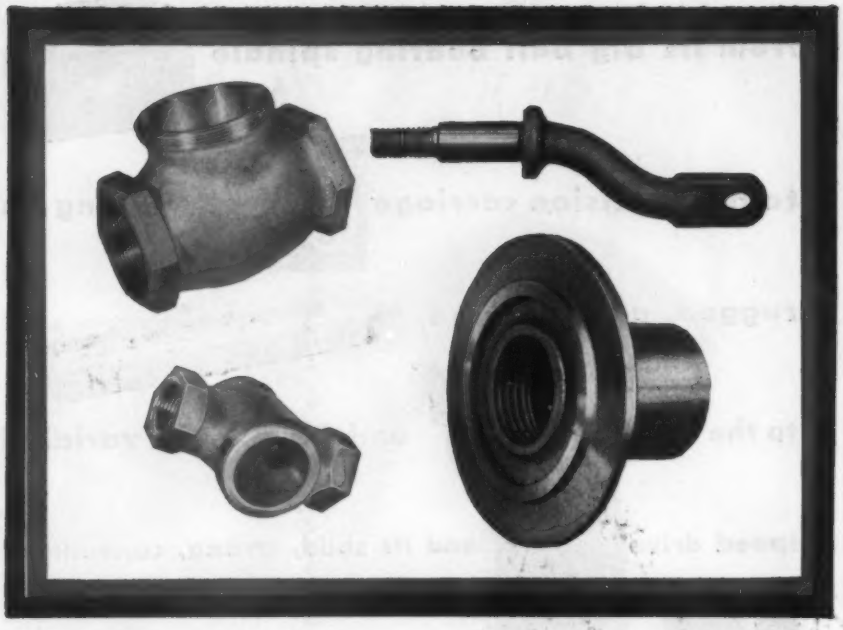

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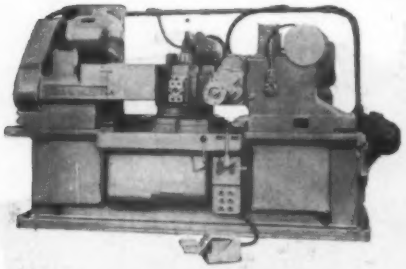

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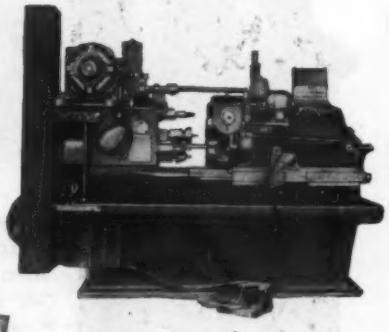

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cate nature, he will acknowledge his opportunity and do his level best to make good. If his instructions are clear and the work is such that no previous experience is necessary in order to do the job, then there is no reason why he wouldn't excel over the experienced man, who naturally considers it beneath his dignity to compete.

Harrison Mitchell
Topeka, Kan

Is THERE a new kind of machine operator coming up? Over here in Britain, they're springing up like mushrooms, not because they're better than lathe hands, but because lathe hands are in short supply. Shop stewards are so busy with the phenomenon that they are demanding to be paid by their employers to do full time *union work* and, in some cases, this demand is being met. One result is that every other operator wants to be a shop steward, to boss the boss about, to tell him how to run his business and to be paid by the boss to do so.

With so many new, single purpose machines coming from the fertile brain of the design engineer, notably in America, the new-type operator is inevitable, but it has all happened before. These new machines are the engineer's dream come true: "half thous; without fine file or emery cloth, "spot-on" sizing by dial setting, finger-tip control, etc. It's all very wonderful and stimulating, but no more revolutionary than the forward march of an earlier

"I'll be relieved when this prosperity is over and Harry can quit worrying how long it can keep up."

"Silica in die castings was shortening tool life"

Because of the silica content in zinc aluminum alloy die castings, a well known midwestern manufacturing company had the problem of shortened tool life. During a routine call, Sinclair Lubrication Engineer K. W. Cross learned of this difficulty in machining.

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generation that saw the marvel of high-speed steel and the introduction of machines of suitable rigidity and speed to reap the benefits the new steel had to offer.

All those improvements we old-timers took in our stride, and then, machinist force adjusted its ideas and methods accordingly. A new kind of machinist did not then arise, but an existing machininst category became transformed by force of circumstances. The change took place gradually and naturally, and little trouble was experienced in finding skilled workers sufficiently adaptable to master the new methods called for. I should say, history will repeat itself in our time—why should it not—provided enough lathe hands are available. If not, the pick of the unskilled will be "Paddy the next-best-thing."

After all, unskilled men all over the world man railway signal cabins on mainline tracks. They are taught to master the layout of a complex multitude of levers and switches. They shoulder a heavy responsibility and kill many fewer people than do car, bus, or lorry drivers on the road. Notwithstanding, I profoundly disagree with Al's implication that lathe hands cannot successfully be taught to operate complicated machinery, while an unskilled man from the shipping section can. Al seems to me to have got it all wrong or else he must have a whale of a lot of hams on his lathes.

If the operation of those modern, high-speed, single-purpose machines calls only for manipulative dexterity,

"This way he can spot tool or machine trouble right away."

twiddling pushbuttons, knobs and light switches, men could be held over for more arduous and, perhaps, more skilled work, in favor of touch-typists who could be employed on the new machines, instead. There is a definite analogy here, since, should the touch-typist have her left or right hand one key out of the proper location, she can provide a lot of dud work before the sequence mistake is discovered. Of course, the cautious touch - typist frequently glances away from her shorthand notes to check on her typing and thus reduce the chances of error.

The foregoing is prompted by Al's dictum "We needed just a fast-moving operator. I guess a lathe hand knows too much about the machine, and tries to see exactly what's going on. This new man doesn't worry about what's happening; he just keeps moving." Like the cautious touch-typist, it would probably pay the company did the new man frequently glance away from his levers and switches to check his results.

Ed cannot claim, with truth, that it's the man who's important, not the machine. The machine is equally important; the one is the complement of the other. The machine must have an operator and, since Al admits the complexity of the machine, I would pin my faith on a skilled man to secure highest production, acceptable production. I cannot believe that an average, good-skilled man would be less teachable in new operating methods than an unskilled one. This is not to suggest that *no* unskilled man could, after training, make as good a show as a skilled machinist.

There are some excellent unskilled men who have never had a chance to show their paces on semi-skilled or skilled work, and who surprise us with their adaptability and dexterity when the opportunity comes their way. There are many others of a contented or retiring nature who, because of their early environment, started off in blind-alley jobs and came to regard such jobs as their niche in life, till some circumstance jolted them out of the rut, into the limelight, to surprise all who beheld their resource and versatility. The records of two world wars bear witness to that, both on active service and in industry.

That fact, however, does not bear out Al's contention that unskilled men are faster than skilled men as a general rule. Al's unskilled man may, of course, be an exception or one of the exceptions that pop up here and there in every sphere of activity. Most experienced execu-

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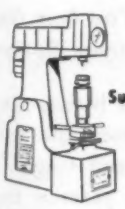

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tives would accept that. None, or at least, few would believe that, in general, unskilled men are faster or better producers than skilled men.

C D Mackinnon
Lanarkshire, Scotland

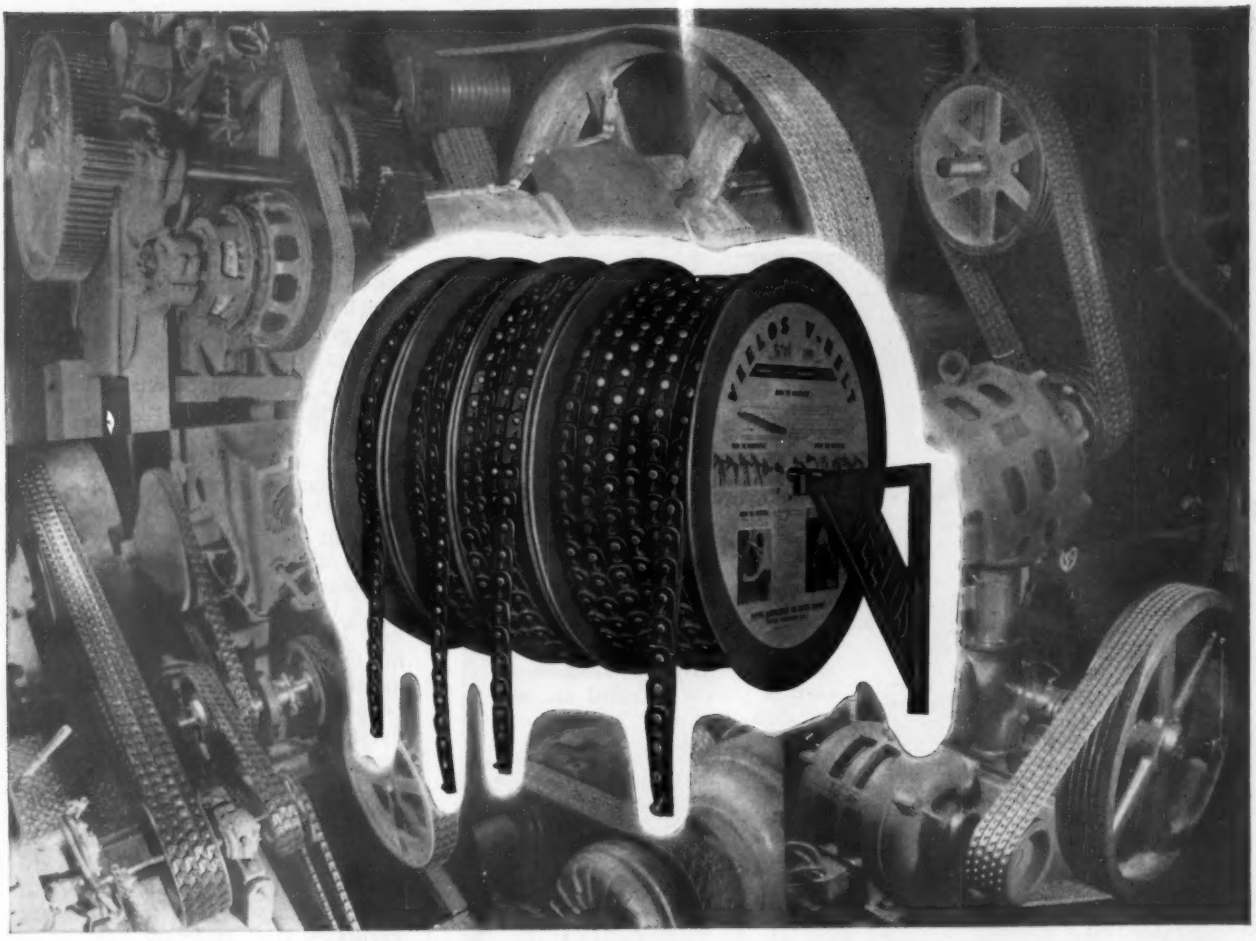
AL MUST BE KIDDING ED when he says that the trouble with the new machine was the lathe hand running it, and that a man from the shipping room sped it up. Just as though the most important thing in running a machine is to turn it fast. But what will management say if the machine, cutting tools, or workpieces are ruined? Should not every man running a machine have experience enough to be able to judge these important facts? If not, it would mean that all training is waste of time. I think this is an unbelievable tale that Ed will not accept.

To break in a man who has not had previous experience on other types of machinery on an expensive automatic special-purpose machine, cannot be done simply by turning switches or moving control levers. But why was not the lathe hand broken in the same way? It seems to me that this would have been easier than breaking in an entirely inexperienced man.

An automatic unit of this kind is a very complicated and sensitive piece of machinery that should not be left in the hands of an ignorant shipping hand. Only an expert on other types of machines should be ordered to work it if no specialist were available.

Al's claim that the lathe hands he used when running in the machine knew too much about machines

"I got it together with only half the parts these specifications call for . . ."



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keeps your drives on the go

Take a look at the illustration above—there's a *complete* v-belt inventory. Those four 100-foot reels of Veelos—the adjustable v-belt—in the O, A, B and C widths can replace up to 316 different sizes of endless v-belt. Of course, when you use only one or two widths of v-belt, you stock reels of only those widths. This 4-reel Veelos v-belt inventory is easy to maintain, stores in a space only 16 inches square, and is ready when you want it.

But inventory saving is just a part of the Veelos story.

Veelos adjustable v-belt is *easier to install*—in many cases installation is completed in 50% to 90% less time.

Using Veelos means you don't have to re-set motors or remove outboard bearings. Veelos v-belts provide *vibrationless, full power delivery*. A demonstration on an electronic vibration analyzer will show you and prove to you that Veelos v-belts *reduce vibration up to 90%!*

Switch to Veelos adjustable v-belt—the one v-belt that keeps your drives on the go. See your Veelos distributor. Write for your copy of the facts-packed Veelos Data Book.

MANHEIM MANUFACTURING & BELTING COMPANY
601 Manbel Street, Manheim, Penna.

VEELOS
THE BALANCED
LINK V-BELT

ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

Veelos is packaged on reels in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. VEELOS is known as VEELINK outside the United States.

2012

YOU *Can* AVOID DIE COSTS COMPLETELY!

On Your Next
STAMPING ORDER

Yes, you can – but it's not *necessarily* the best thing for you.

You want the lowest unit cost – *for the life of the part*, including re-runs. It may well be that our **Machine-Cut Method**, with no die cost, does work out best.

Or, it might better be our **Short Run Method**, using economical blanking dies and stock punches.

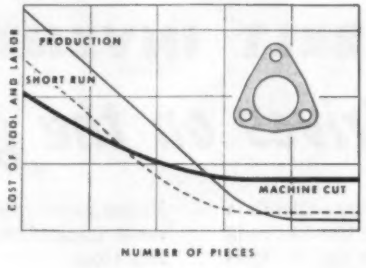
Sometimes, even with very short runs, it pays to use our **Production Method** with a standard die or our own surprisingly inexpensive Hecht-type tool.

In *any* case, the decision is a technical one based on many factors, not just length of run. You save money when the correct decision is made.

WE USE ALL THREE METHODS — LET US MAKE AN IMPARTIAL DECISION FOR YOU

For example, take the part illustrated. From 1-65 parts, our Machine-Cut Method is most economical. At 65 parts, the Short-Run Method is best until, at 7,000 units, the standard Production Method is most satisfactory.

These breaking points as charted vary drastically with every stamping, but the general principle remains the same.



LAMINATED SHIM COMPANY, INC.

Manufacturers of ALL TYPES OF SHIMS

STAMPINGS DIVISION

ONE PIECE OR ONE MILLION

STAMPINGS DIVISION, LAMINATED SHIM COMPANY
3110 Union Street, Glenbrook, Conn.

Gentlemen:

Please rush me my free copy of "SERVICE IN STAMPINGS"—the 12-page, illustrated booklet full of helpful facts on the economical buying of stampings.

NAME _____ TITLE _____

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to be able to run the new machine at top speed cannot be true. If a lathe hand doesn't run a machine of this kind at top speed it is because he is afraid to damage it; the reason is not that he cannot speed up the machine. Any mechanic used to machine tools can see through that argument. If Al or Ed do not have that insight they ought to take an apprentice course in operating machine tools.

A green man is likely to wear the machine out quickly or break it up in time. It is impossible for even a skilled mechanic to run any complicated machine without proper training, and therefore no shipping-room hand can run it either. The claim to the contrary is impossible. As long as Al has not proven the man's ability to run the new machine I remain skeptical.

As to the question if there is a new kind of machine operator coming up, I would answer that if new machines are designed for special-purpose productions and those productions are so simple that no experience is necessary to run them, then the switch-snapper will do, but I don't believe this will happen for hundreds of years to come. Ed should change his attitude toward the machines and claim that both skilled men and good machines are necessary and important.

A E Fristedt
Stockholm-Bromma, Sweden

BLUEPRINT FOR ERROR

If errors in production can be traced to bad blueprints, should the blame rest on Engineering, or on the worker who tries to interpret the poor prints? Is there any line at which prints should be returned for illegibility?

THIS PROBLEM of errors on blueprints is a very realistic one and occurs in every shop at one time or another. Drafting is a language; a means of communication. Drafting is not an end in itself, except as an unfortunate narrow-minded view within the drafting room. Drafting is a way of specifying requirements. Drawings exist because one picture is worth a thousand words; that is their whole reason for being. Drawings are a method of storing and transmitting information which can be expressed most economically and effectively with the aid of pictures. The purpose of the drawing is the communication of information from the designer to the shop. If a draw-

ing cannot be read it might better not exist.

I have worked in shops where the drawings consisted of rough freehand sketches on the back of a greasy lunch bag. There have been other jobs where the shop never worked from anything other than fresh clean prints of carefully drawn and beautifully shaded orthographic projections complete with a formidable list of approval signatures.

In this particular case the mechanic is at fault, for he fell down on his job. When a man is given a print and an order for parts, the first step is to read everything on the order and everything on the print. Many shops have a notation on each print in large type "Read all notes and instructions on this print before starting work." Many men are prone to check the size of the stock required and immediately start sawing it to size. About the time the hacksaw is half-way through the bar they discover either by themselves or through a note on the print that they should have allowed an extra three inches for chucking. While it is the responsibility of engineering to supply the production department with clear legible prints, they cannot be responsible for keeping these prints in good condition while they are in the shop. If certain dimensions on the prints are not clear, then the machinist is attempting to make the parts without complete specifications. He is at fault for going ahead with the job with incomplete knowledge of the requirements.

The shafts are made and are not acceptable. They must be reworked or replaced. The important point is not so much who is at fault, but what can be done to prevent a recur-

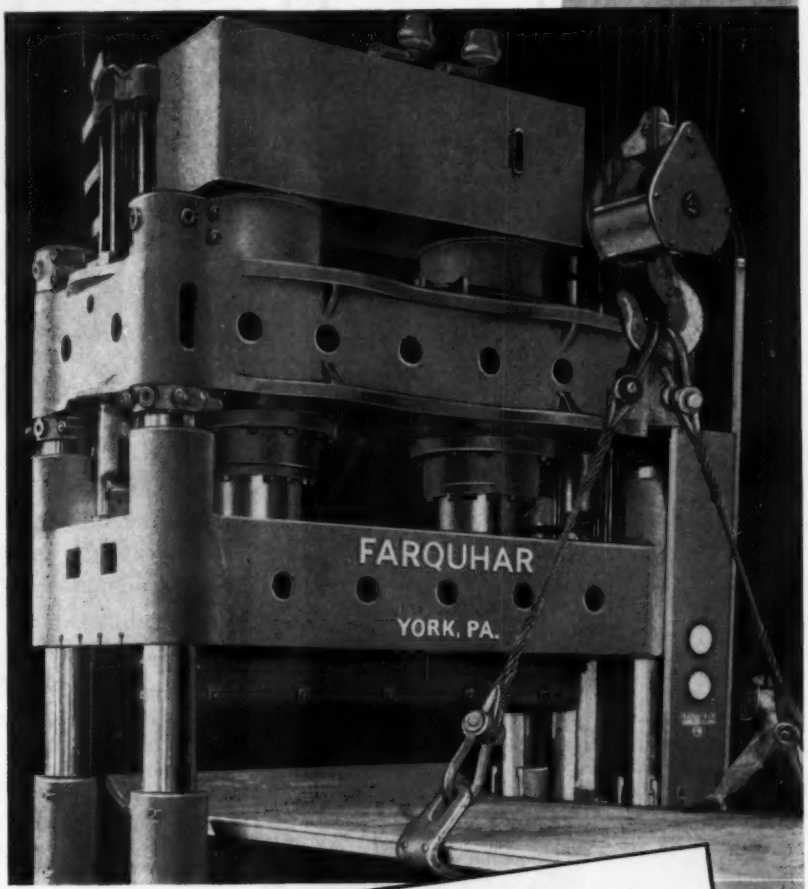
"The last company I worked for gave free life, health and accident insurance, Christmas and quarterly bonuses and a month's vacation with pay but they folded."

Farquhar

HYDRAULIC PRESSES

Form Heavy Steel Plates Accurately

1000 TON FOUR COLUMN PRESS



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With easy to operate Servo Controls, speed and pressure respond instantly to touch. Large open work areas make it simple to perform a wide variety of plate forming work. Hydraulic systems completely self-contained with filters and coolers. Farquhar Presses are backed by over 50 years of experience manufacturing all types of heavy presses.

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THE OLIVER CORPORATION

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...You can't beat these drop-head dies for easy work, perfect threads... and long trouble-free service!

Every RIDGID Pipe Tool TESTED before shipment

RIDGID

Drop-Head Dies
for ⅛" to 2" pipe

Each size die head snaps instantly into ratchet handle. Dies reverse quickly for close-to-wall threads, easily removed for regrinding. Left hand dies available.

OOR, ⅛" to 1"
111R, ⅛" to 1¼"
12R, ⅛" to 2"

Buy them from your Supply House.

Every RIDGID Pipe Tool individually TESTED before shipment.

Carrier free with complete sets.

The Ridge Tool Company • Elyria, Ohio • U.S.A.

rence of this type of error. A lot of time can be spent in placing the blame, but this will not fix the shafts, or prevent a repeat performance.

I believe that the difficulty lies in the relationship that exists between the men and the foreman. In any ordinary shop even if relations and morale were only fair, the men would check with the foreman if there was the slightest doubt about any part of the job, dimensions, finish, or materials. The thing to do is to check the relations in this department to see how conditions can be so bad that two men ran through this job and made these shafts while a doubt existed as to the correct diameter.

There must be a thick wall between the men and the foreman to cause a man to gamble on a dimension on a job of this size rather than ask for a new print or a verification of the dimension. Blame the man at the machine; fire him if you will for he is at fault, but better check a little deeper for the source.

George H Koslow
Bronx, NY

OFF THE CLOCK

Will eliminating the time-clock method of recording hours worked tend to raise morale? Will the men, on their honor, remain punctual, or will they abuse the privilege?

WHEN A SHOP puts a new man on they contract to pay him a certain

"— — And besides the sweepstakes tickets, I'm entered in six big prize contests . . . ."

For high production

AT LOW COST

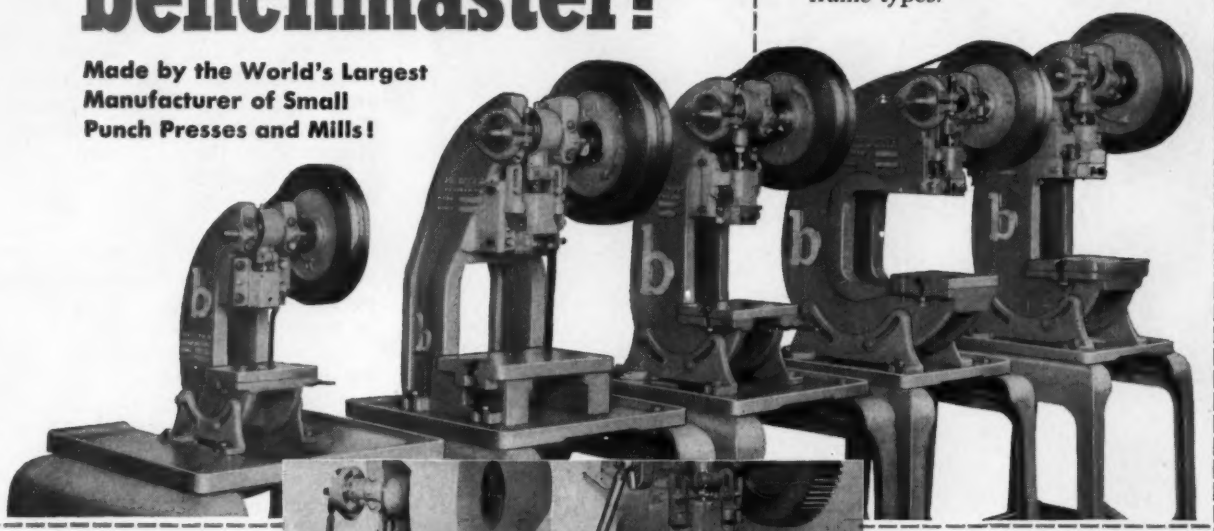
...you can't beat

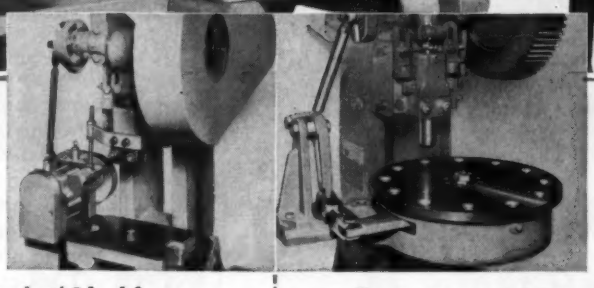
benchmaster!

Made by the World's Largest Manufacturer of Small Punch Presses and Mills!

benchmaster **PUNCH PRESSES**

The most outstanding small presses in America and leaders for more than a decade! Now made in 2, 5 and 8 ton capacities. Many model variations for all manufacturing requirements... plain, back-geared, deep throat, half-presses and fixed-bed gap-frame types.





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AUTOMATIC FRICTION ROLL FEEDS

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benchmaster
ROTARY INDEX FEEDS

Converts your presses for automatically *marking, crimping, assembling, reaming, trimming, etc.*, at speeds up to 6000 strokes per hour. Easy installation—4 bolt mounting. Two sizes: 12" or 15" tables, 10 or 12 stations. Larger sizes on special order.

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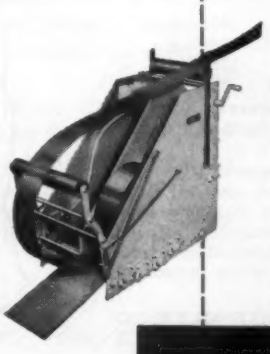
KOIL KRADLES

Supplies a slack loop from which any machine can draw. Takes the drag off automatic feeding devices, increases feeding accuracy on progressive or multiple die operations; puts through more footage per hour. Many sizes: 1200 to 4000 lbs., 36" to 60" coil diameters, 10" to 28" widths. Larger capacities available.



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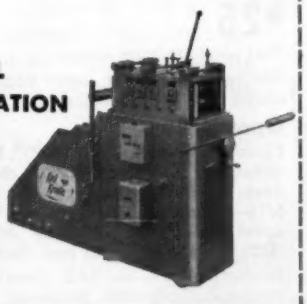
KOIL KRADLE AND ROLL STRAIGHTENER COMBINATION

Straighteners also available as single units. Feed rate variable 25 to 100 rpm, straightener thickness capacity .200". Other sizes available.



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World's largest manufacturer of small punch presses and mills.

Benchmaster Manufacturing Co., 1835 N. Rosecrans Ave., Gardena, California

PRODUCTION UP 53%

FEWER REJECTS

HOWE & FANT TURRET DRILL CASE HISTORY

#25

Part — Aluminum elbow

Fixture — 3 position, lever transfer, air clamp, bolted to machine table.

Operations

I Load. **II** Spot 2 holes 3/8 x 90°. **III** Index turret and drill 2 holes .272" dia. .625" deep. **IV** Index turret and tap 2 holes 5/16—24 class 3 fit .520" deep. **V** Index turret and core drill 1 hole .801" dia. .410" deep. **VI** Unload and clean.

Production rate — 73.2 pieces (512.4 machining operations per hour).

Comment

Job is a "natural" for the H&F turret drill. Part is clamped by air in simple fixture lever actuated to provide 3 predetermined working positions. This assures minimum transfer time and proper location of part under working tool. Each tool turns at optimum preset speed in this case:

Spot drill	1825 r.p.m.
.272" dia. drill	2375 r.p.m.
5/16—24 tap	1150 r.p.m.
.801" dia. core drill	825 r.p.m.

Tap automatically reverses at twice forward speed at preset depth. All depths controlled within .002".

Set-up increases production 53% over 4-spindle drill press with box jig. Rejects are virtually eliminated, tool life greatly increased. The H&F installation has won unanimous operator approval by appreciably cutting fatigue while increasing output.

WRITE FOR THE H&F CATALOG AND FURTHER TIME STUDIES

hf HOWE & FANT, Inc.

27 FITCH STREET • EAST NORWALK • CONNECTICUT

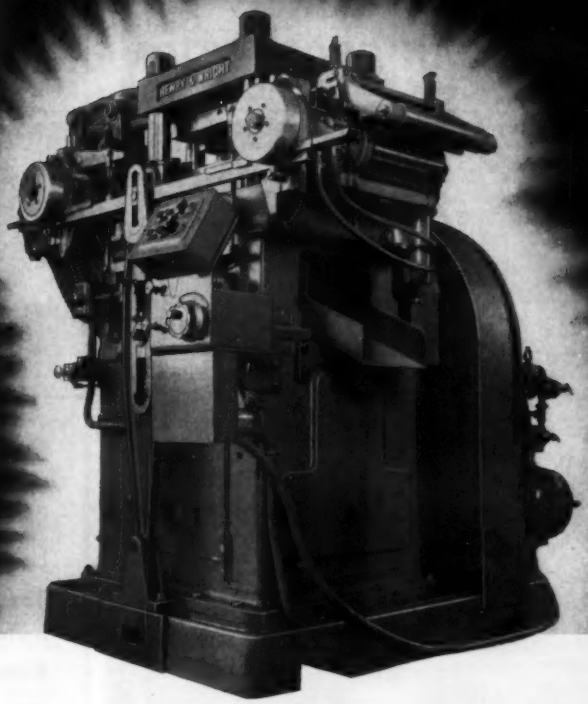
definite hourly wage. This is probably the most important single consideration of the hiring agreement. Money is the common denominator of value. Just about everything can be reduced to representation by a figure behind a dollar sign. When an employee has completed his week's work he expects every last cent of the product obtained by multiplying the hourly wage by the hours worked. It is his, and he wants it without any rounding off, or approximating. By the same token management expects the full measure of work from the employee without any adjusting or approximating. There is no doubt about the quantity of money in the pay envelope. It is easily counted. Why should not the time paid for by management be measured as carefully? When steel bars or bags of potatoes are purchased, accurate measure is expected to insure that full value will be received for the money.

The shop or business seems like a big impersonal thing with unlimited supplies of money available. It is easy for employees to get this impression. From here it takes but one short step for them to feel justified in expecting the plant to give them full pay for short measure of work; not because it is really justified, but because the plant seems so big that it will not notice the shortage. The organization has no alternative but to measure what it receives, for unless you can measure, you do not know.

I believe it would be a mistake for any plant to abolish the time-clock method of checking in and out. While it is true that most employees

"Well it's too bad the boss is out and can't talk to me about a raise this morning, but if you see him tell him that the shoes on his drapes need polishing!"

HENRY & WRIGHTS



Extra Rigidity Assures Extra Long Die Life at High Speeds

From the heavily ribbed floor plate to the high strength upper crosshead casting, Henry & Wrights are built to achieve maximum precision in punch and die alignment. Go right through the specifications of a Henry & Wright — the hand-scraped bronze bushings, the rigidly locked crankshaft connection, the solidly keyed guides in the lower crosshead, the low unit stress guide rods — and you can understand why tools function more efficiently, dies last three to four times as long and work quality goes up and stays up.

The extras you get in Henry & Wrights — and only in Henry & Wrights — provide that margin of operating safety and efficiency you want for immediate and prolonged savings in stamping costs. Step up to a Henry & Wright to be sure of peak performance.

Our catalog is yours for the asking. Please write Henry & Wright, Division of Emhart Mfg. Co., 481 Windsor St., Hartford, Connecticut.

The most efficient metal stamping method known...

HENRY & WRIGHT DIVISION OF EMHART MFG. CO. **HARTFORD, CONNECTICUT**

5th in a Series

OF HIGH PRODUCTION CASE HISTORIES

ASK BAIRD ABOUT IT

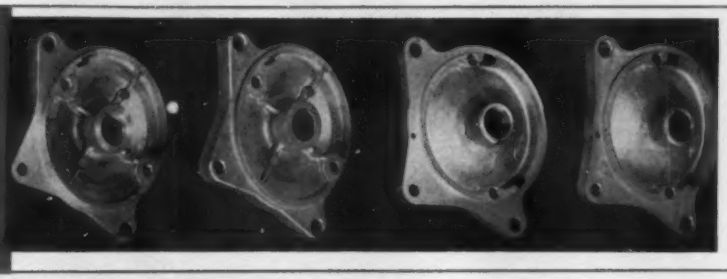
Baird Automatic Chucker again hits *PEAK PRODUCTION*

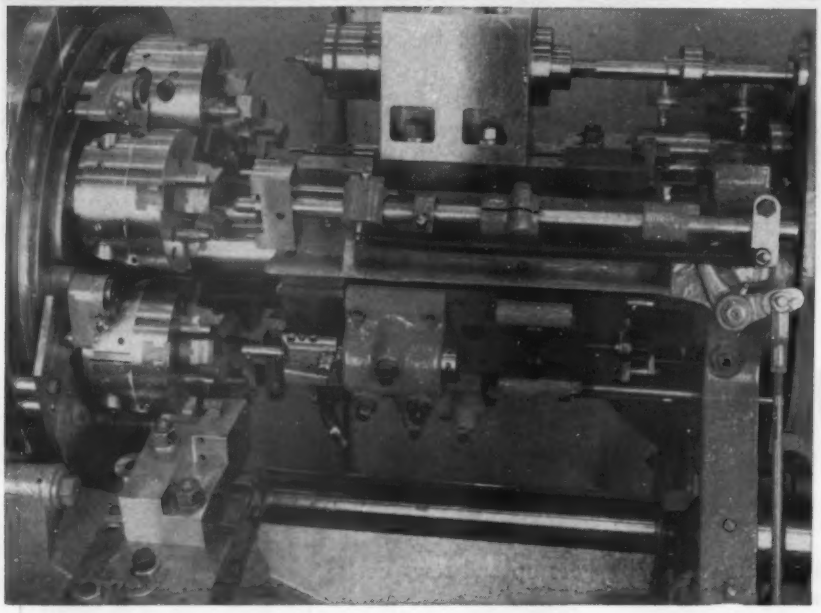
PART: Rear End Plate of Starting Motor

MATERIAL: Die-Cast Aluminum

PRODUCTION:

420 PIECES PER HOUR





OPERATIONS

Back face and chamfer one end of hub, using a recessing tool. Bore center hole concentric with flange diameters with high speed boring head. Face both sides of flange and turn the diameters concentric with hole. Bore a small hole off center with high speed boring head and tap two holes. The work is located in proper position and held stationary while the off-center hole is bored and the two holes tapped.

TOOLING...

The Baird Automatic 76H Chucking Machine is arranged for single indexing and with a recessing tool for back facing . . . high speed boring heads . . . two-spindle lead screw tapping attachment. A typical example of the endlessly varied and basically simple arrangements possible with this versatile unit.

Write Dept. AM

THE BAIRD MACHINE COMPANY

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WHERE YOU WILL GET THE HELP OF SPECIALISTS ON THESE ESSENTIAL PRODUCTION PROBLEMS:

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • PRECISION CASTINGS

9BA55

could be relied on to be honest about signing in and out, it presents a great temptation, and some few could not resist. They might be so few that the time lost to the company in this manner would be very small. However, it would still present a serious problem because of the adverse effect that these few would have on the others.

There is nothing to be gained by eliminating the time clock. No matter how liberal the company becomes in regard to rest rooms and recreation facilities, bonuses, and other employee benefits, you cannot get away from the fact that the company is in business to show a profit on operations. They are buying materials and labor, and selling a finished product. They cannot afford to remove the time clock any more than they can afford to stop counting, weighing, and inspecting materials.

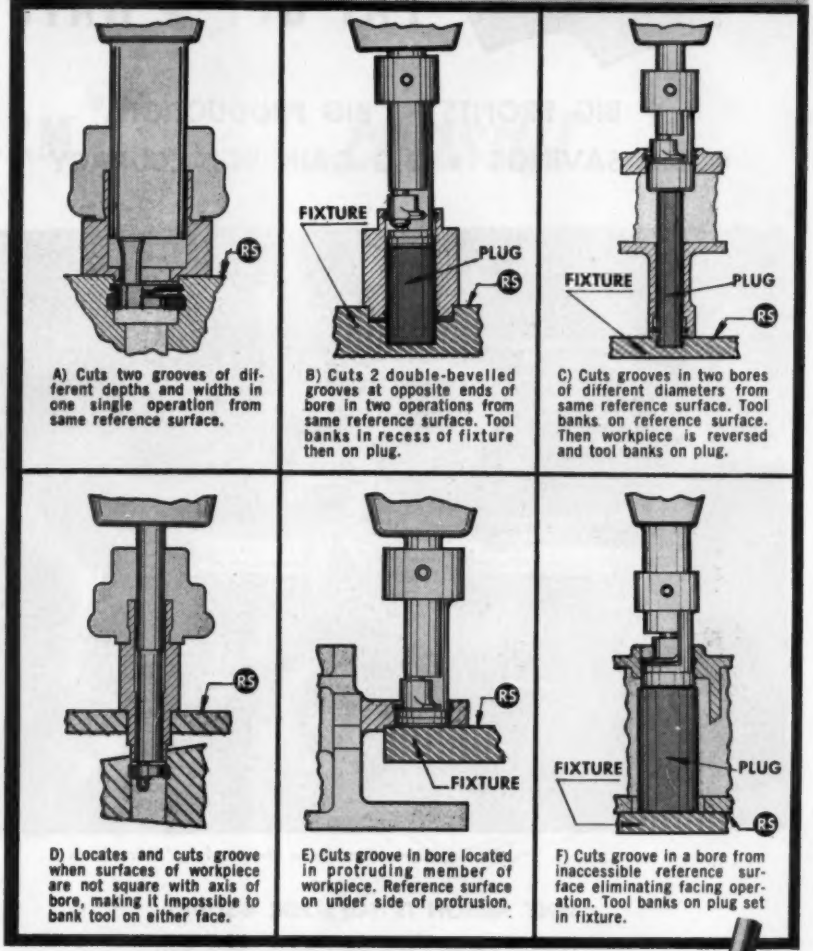
Clifford Molloy
Bronx, NY

WHY HAVE a time clock? Management installs the time clock for the same reason that they install a scale in the receiving department, namely, to insure that they receive what they pay for. They grow to regard human time and effort as a commodity, like bar stock.

The modern industrial plant is a very impersonal place where everything is directed toward the single objective, that is, production. I believe that Al is right in his belief that it will be better to permit the men to sign in and out. In the plant where parts travel by conveyor, and orders and instructions are received

"Er — Perhaps you had something less radical in mind . . . ?"

Even Unskilled Labor Can Use This Versatile Tool Accurately! It Simplifies Internal Grooving Problems, Cuts Production Costs!



A) Cuts two grooves of different depths and widths in one single operation from same reference surface.

B) Cuts 2 double-bevelled grooves at opposite ends of bore in two operations from same reference surface. Tool banks in recess of fixture then on plug.

C) Cuts grooves in two bores of different diameters from same reference surface. Tool banks on reference surface. Then workpiece is reversed and tool banks on plug.

D) Locates and cuts groove when surfaces of workpiece are not square with axis of bore, making it impossible to bank tool on either face.

E) Cuts groove in bore located in protruding member of workpiece. Reference surface on under side of protrusion.

F) Cuts groove in a bore from inaccessible reference surface eliminating facing operation. Tool banks on plug set in fixture.

Amazingly versatile! Your toughest recess cutting problems can be met simply and efficiently with the Waldes Truarc Grooving Tool because it offers a whole range of possibilities beyond the range of ordinary recessing tools.

Wide Cutting Range! The Waldes Truarc Grooving Tool comes in 5 models . . . enabling you to cut accurate grooves in housings with diameters from .250 to 5.00 inches.

Send Your Problems to Waldes! Send us your blueprints . . . let Waldes Truarc Engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job. There is no obligation!

Write NOW for a 20-page manual containing full information on Waldes Truarc Grooving Tool

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Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool. (GT-2-53)
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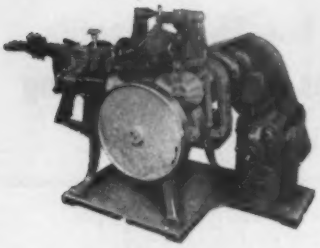
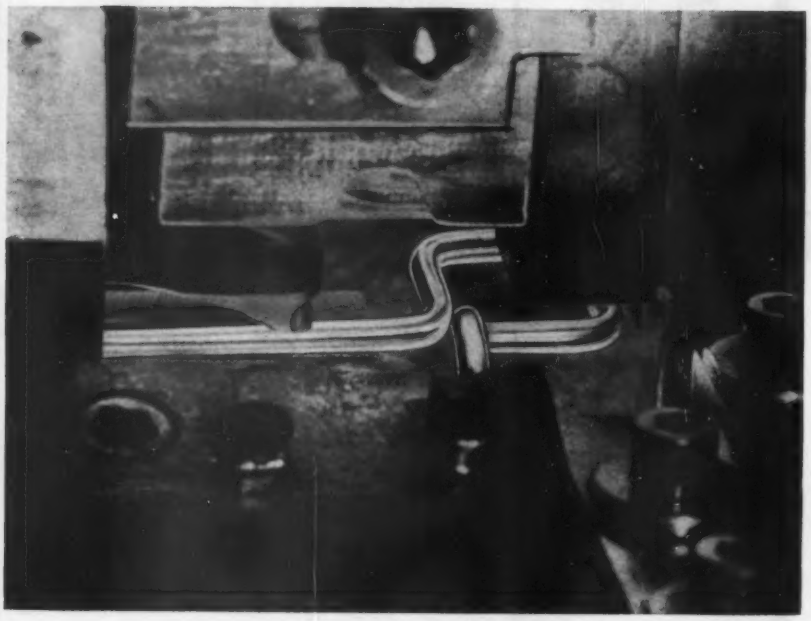


NILSON 4-SLIDES PAY OFF 4 WAYS

• BIG PROFITS • BIG PRODUCTION
• BIG SAVINGS • BIG GAIN IN ACCURACY



Forming Operation: Meter Shunts of 3/16" Wire Stock

WHY NILSON IS TOPS FOR 4-SLIDES:

Nilson 4-Slides are built for rugged duty
Form both ribbon metal and wire stock
Press capacities 8 to 75 tons, wire diameter to ½"

16 Models Available, Including Combinations of Horizontal Press and 4-Slide

YOU PROFIT BY: Automatic Operation • Increased Production • No Secondary Handling • Improved Products • Fewer Rejects • Lowest Initial Cost

Nilson engineers are always available for consultation on forming problems. Bulletin #61 sent on request.

Nilson's 3 tilt and 3 stationary reels handle wire or ribbon stock coils up to 500 pounds.

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Automatic Chain Making Machines • Staple Forming Machines • Wire and Stock Reels • Wire Straightening Equipment • Slide Feeds for Presses • Wire and Ribbon Stock Forming Machines

on printed forms, there is little enough opportunity to permit the men to distinguish themselves from the machines. Parts are made by men, not by machines; the machines are there to assist the men. It is important to the success of the plant that the employees feel that they are wanted and that they constitute a necessary part of the organization.

Few managements realize the need that all men have for appreciation of their work. Everyone demands recognition of individuality; permitting them to sign in and out, instead of punching a clock, is one way of according it. No one wants to be merely a gear in a machine or, what is worse, a gear without a machine.

The plant is large and has a personality of its own in the field of industry. Anything that gives a worker a feeling of participation in, and identification with the big organization raises his self-esteem and reflects back on him some of the prestige of the concern itself.

Sing Yen
Brooklyn, NY

THE AVERAGE EMPLOYEE is functual and has a good attendance record. He wants to do the right thing and live up to all the rules and policies. It is the few who don't who cause the firm trouble. It is because of these few we have time clocks.

The time clock is an aid to the supervisor and relieves him of the necessity of counting noses first thing in the morning. The foremen are usually more busy in the morning, getting off to a good start. Without the time clock the foremen would have to keep a record of punctuality and attendance and write up any time off. For my part I think the foremen have enough to do without adding more.

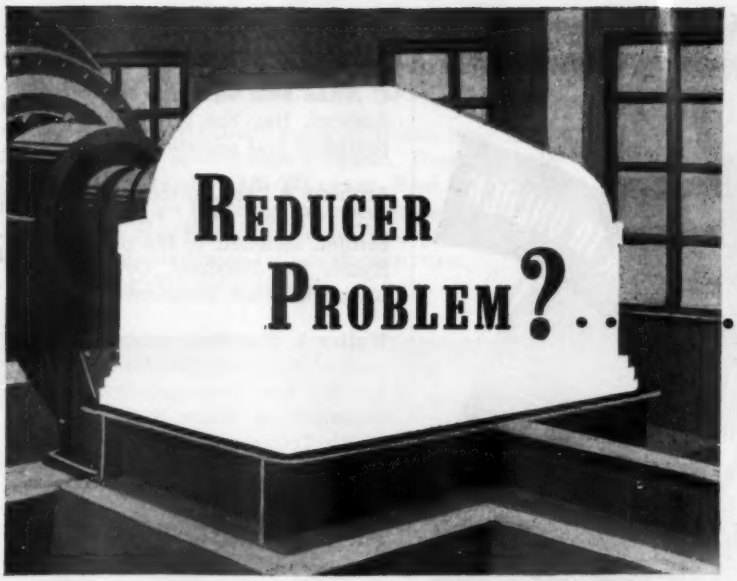
In my opinion management would be inviting trouble having employees fill out their own time cards. There are always some who take advantage, especially when there are overtime hours. Management has enough headaches keeping employees in line without adding a hot potato like this.

A E Salmons
Philadelphia, Pa

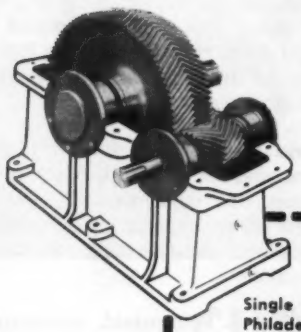
•

Names in the News . . .

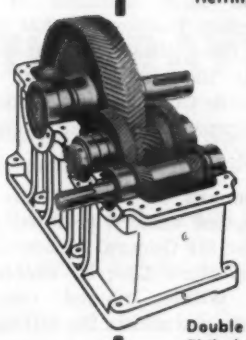
Bill McAvey, formerly eastern division sales manager for Do-All Co, has been appointed general manager of Burg Tool Manufacturing



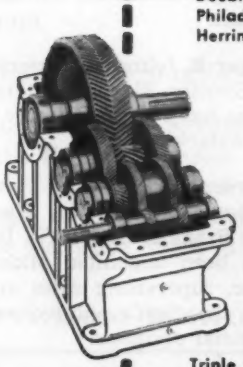
REDUCER PROBLEM?. . . . . *consult*



Single reduction
Philadelphia
Herringbone Reducer



Double reduction
Philadelphia
Herringbone Reducer



Triple reduction
Philadelphia
Herringbone Reducer

If you have a problem involving high horsepower speed reduction with heavy shock loads, Philadelphia Herringbone Reducers are the answer. These quality-built units are available in Single, Double and Triple Reduction types, offering a wide selection of capacities and reduction ratios. The continuous tooth type herringbone gears assure evenly distributed pressure over each tooth from the top to the working depth line, — which means exceptionally long life, minimum vibration, quiet operation and maximum transmission of power . . . Thousands of Philadelphia Herringbone Reducers are in daily use, in most every line of industry. Be convinced, send for Catalog H-49.

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WRITE for descriptive folder No. A-465. Also ask for Catalog 202 showing the latest patterns and sizes in Williams broad line of industrial tools.

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Co's Burgmaster eastern sales division, New York City.

C Allan Fee, secretary of ACF Industries, Inc, has been elected vice president and secretary.

Anthony A Pack, formerly associated with Vickers, Inc, has been appointed assistant to the president of Hyster Co, Portland, Ore, assigned to special staff assignments.

Walter L Flanders, producing manager of American Machine & Foundry Co, has been appointed works manager of Wales-Strippet Corp, North Tonawanda, NY.

Vincent J Powers, formerly associated with Ex-Cell-O Corp's sales organization, has been elected president and general manager of Accurate Bushing Co, Garwood, NJ.

H J Buttner, formerly manager of Continental Motor Corp's contract division, has been appointed manager of engineering for Le Roi Division of Westinghouse Air Brake Co, Milwaukee, Wis.

Paul O Wernicke, formerly general manager of Simplex Machine Tool Corp, has been named sales manager of the machine tool division of Mercury Engineering Corp, Milwaukee.

Albert S Fehsenfeld, assistant general sales manager of Black & Decker, Towson, Md, has been named to head the newly-created Wholesale Sales Div; **Arthur L Boehm,** Pacific Coast district manager, heads the new Industrial-Automotive Sales Div.

Leonard F Swoyer has been appointed eastern regional sales manager for General Motors Corp's New Departure Div; he succeeds **Robert H Wilkie,** named merchandising manager within the ND sales organization.

Edgar K Johnston, factory manager of Sterling Electric Motors, Los Angeles, has been named vice president, manufacturing.

Vernon D Enwald, West Coast regional manager for Warner Electric Brake & Clutch Co, Beloit, Wis, has been appointed Midwest manager, supervising sales and service for the firm's automotive and industrial divisions.

Russell T Lund, operating manager of National Carbide Co, has been named a vice president.

SAVES $13,500 IN ONE YEAR*

These plastic molds are made of Huron Steel intricately shaped to very close tolerance. They cost $345 per set and produce 125,000 pieces. Each set is then resized with the Raytheon Impact Grinder at a cost of $75. They may be resized two or three times to provide additional full production runs. Cost saving—$13,500 a year.

SAVES $211 ON EACH DIE*

This carbide knurling die is used in the manufacture of fluorescent lamp starters. This die formerly cost $265 each, made by conventional shop methods. By using the Raytheon Impact Grinder for cutting the serrated portion, the cost per die was reduced to $54—a saving of $211 per die.

CUT YOUR COSTS WITH THE RAYTHEON IMPACT GRINDER

- Machines hardened steel, titanium carbide, tungsten carbide—and many other hard or brittle materials.
- Forms intricate carbide dies without sectioning.
- Cuts to 0.0002"—finishes to 8 microinches.
- No heating of material or distortion of grain structure.
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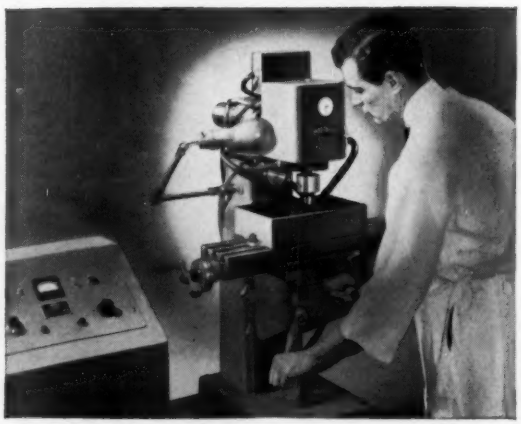
Perhaps you have a problem which can be solved with the Raytheon Impact Grinder. Write Dept. 6120 and our Application Engineering Service will be happy to assist you. For new catalog, request bulletin No. 2-332, Dept. 6120.



Raytheon Impact Grinder for Ultrasonic Machining

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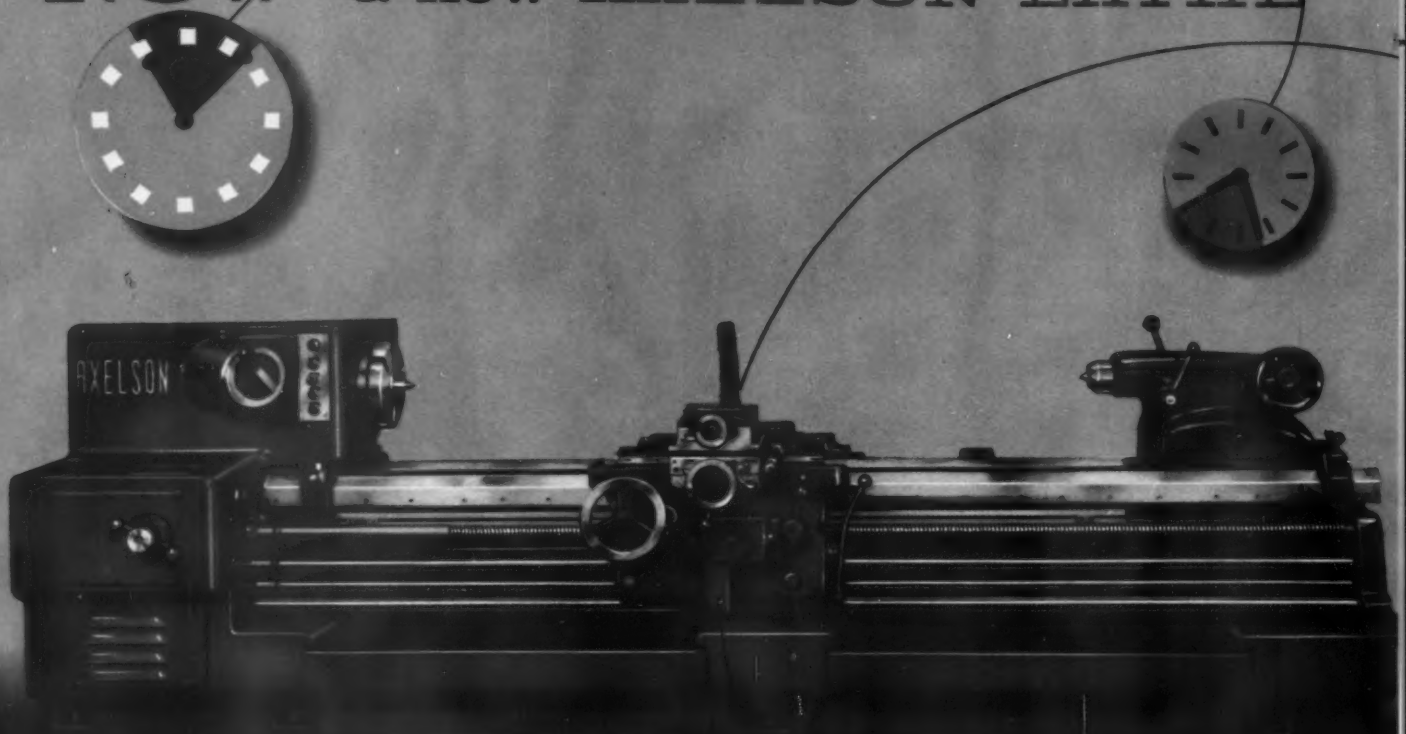

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DIVISION OF U. S. INDUSTRIES, INC.

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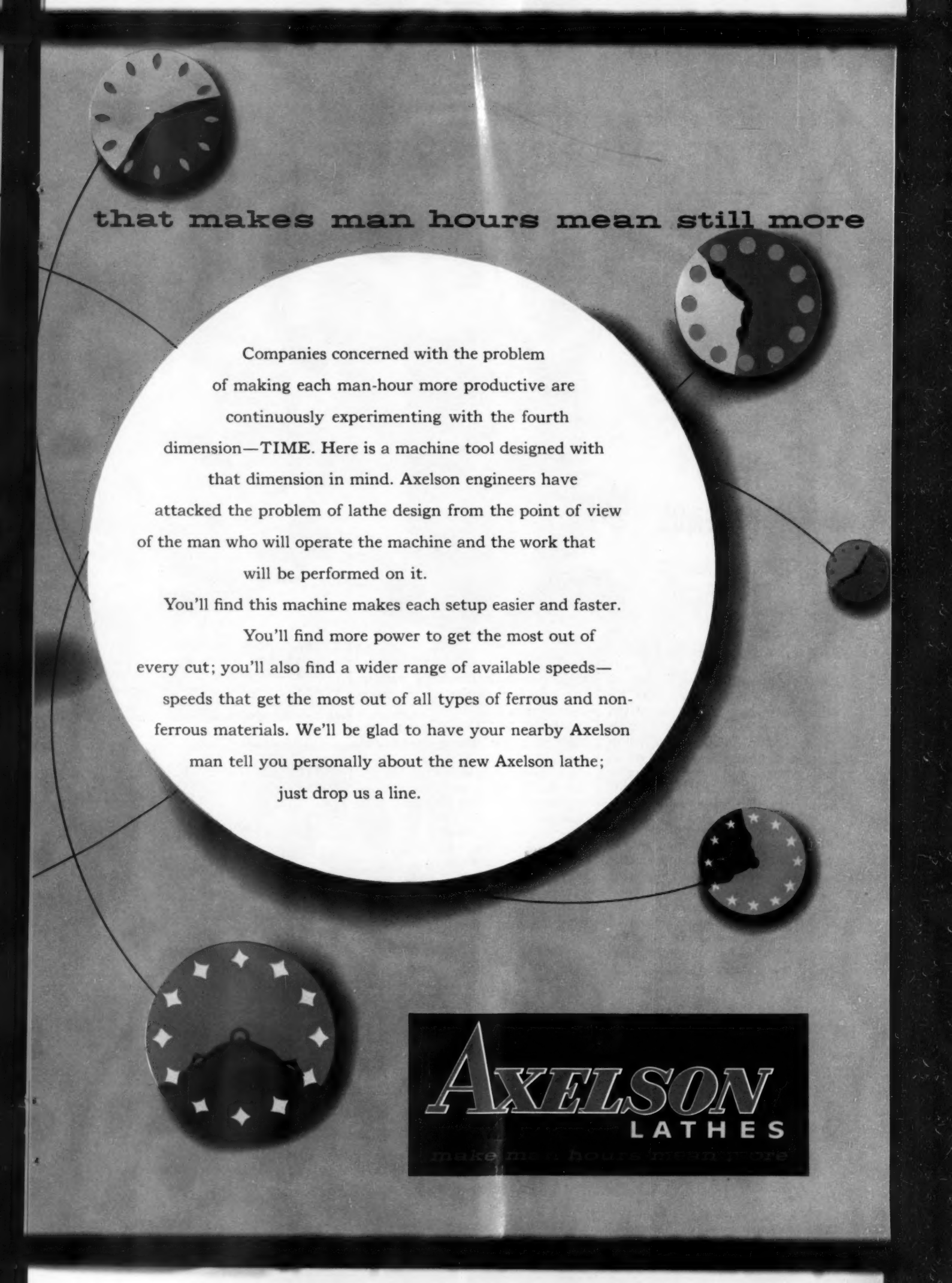
that makes man hours mean still more
Companies concerned with the problem of making each man-hour more productive are continuously experimenting with the fourth dimension—TIME. Here is a machine tool designed with that dimension in mind. Axelson engineers have attacked the problem of lathe design from the point of view of the man who will operate the machine and the work that will be performed on it.
You'll find this machine makes each setup easier and faster.
You'll find more power to get the most out of every cut; you'll also find a wider range of available speeds—speeds that get the most out of all types of ferrous and non-ferrous materials. We'll be glad to have your nearby Axelson man tell you personally about the new Axelson lathe; just drop us a line.
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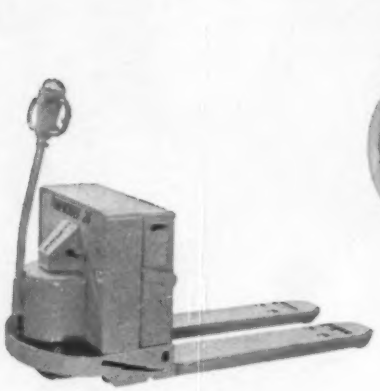
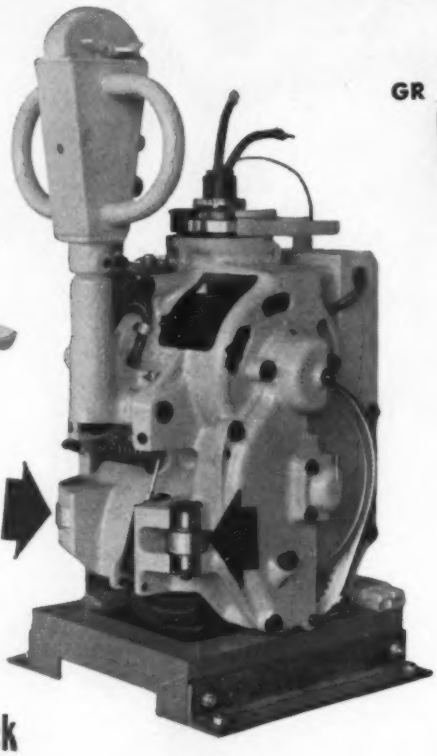




Sealed GUIDEROL® bearings meet design demands of Clark *POWRWORKER* hand truck

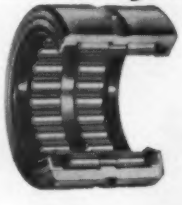
The power head in Clark Equipment Company's Powrworker trucks required a bearing to provide radial support to the wheel-mounted pivoting drive unit. In addition it had to seal out dirt, carry a sizeable load in limited space and adapt to vertical mounting. Sealed GUIDEROL bearings meet each of these requirements.

For instance, the bearings are only 4½ inches above the floor and in contact with contaminating materials such as dirt, chemicals and brine that would freeze up ordinary unsealed bearings. Use of the Sealed GUIDEROL bearings eliminates the need for multiple parts and extra machining of the housing that would be required with auxiliary sealing of an ordinary bearing.

Although limited in size by the fit of the unit into the truck, the GUIDEROL SG Bearings take loads up to 1,500 pounds in absorbing starting and stopping inertias of the truck and the unit.

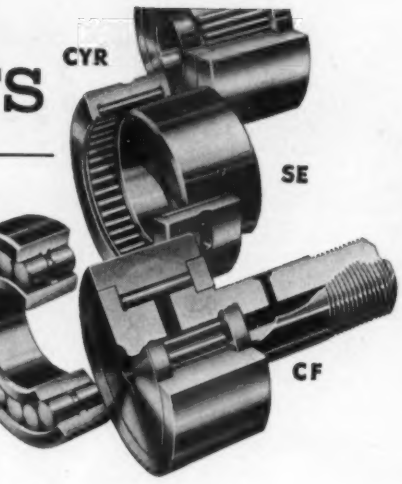
The SG Series bearings operate perfectly and last longer in vertical mounting because the center guided construction provides a guide rail that keeps the grooved rollers in alignment under any load from vertical to horizontal. They are available with built-in single and double seals with no increase in standard Guiderol bearing width.

To help insure product performance and to simplify production and assembly, investigate Sealed GUIDEROL Bearings today.



FOR YOU

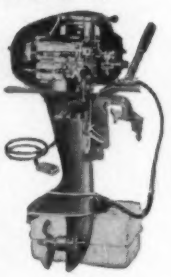
Complete details on the Sealed GUIDEROL Bearing are contained in McGill Catalog No. 52. Send for a copy today.



SIKORSKY USES SEALED GUIDEROL® BEARINGS in HELICOPTER ROTORS

An obvious "must" for helicopter rotors is dependability. McGill Sealed GUIDEROL Bearings help to provide that dependability as drag hinge and flapping hinge bearings in the main and tail rotors of the Sikorsky S-55, helicopter series.

SEALED GUIDEROL® BEARINGS BRING NEW LATITUDE in DESIGN to SCOTT-ATWATER MOTORS



Used as crankshaft support in the new Scott-Atwater Bail-a-matic outboard motor line, Sealed GUIDEROL bearings give more positive seal retainment, make higher operating speeds possible, give greater capacity for future horsepower increases, and simplify assembly.

Insure performance with McGILL®...

50th McGILL Anniversary

MULTIROL®—GUIDEROL®—CAMROL *full type roller bearings*

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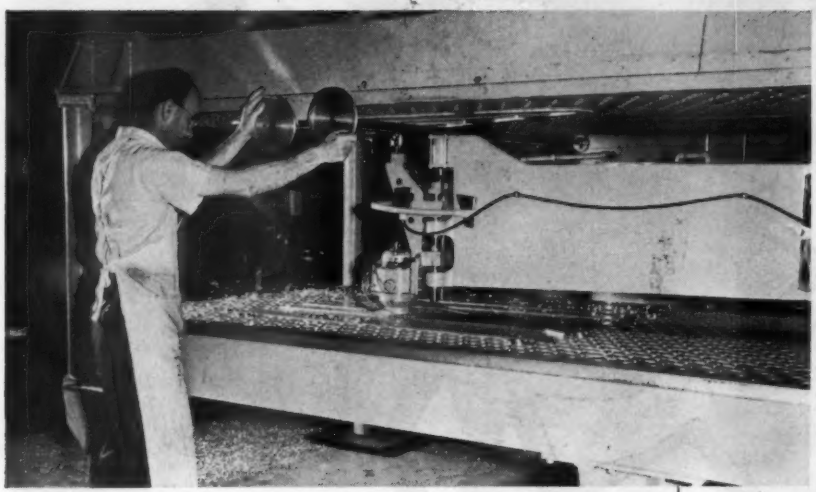
One of a series
MODERN TOOLING TECHNIQUES

100% STABILITY FOUND IN NEW VACUUM CHUCK



Octopus Grip Vacuum Chuck, developed by Convair—a Division of General Dynamics Corporation, San Diego—is shown here on a skin milling machine. Upper chuck holds pattern, lower chuck holds material. Approximately 1000 suction cups can be used to hold skin during milling operation.

Pioneer Tool Engineering, Inc., 1601 E. El Segundo Blvd., El Segundo, California is the licensed manufacturer of the Octopus Grip Vacuum Chuck.

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shows complete range of applications, important mechanical properties, stock sizes and special cast sizes.

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Formula 921-T

cast aluminum tooling plates and bars for use in jigs, dies, fixtures and special machines.

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The suction cups use removable rubber grommets. A screw in the center hole serves as a shut-off valve. This allows any shape skin to be placed on chuck without complicated sealing-off of vacuum source typical of some vacuum-type chucks.

Like all vacuum chucks, specifications for the new Octopus Grip Vacuum Chuck required a high degree of stability due to the close tolerance present in milling operations.

Engineers specified Pioneer 921-T, a specially alloyed cast aluminum tooling material.

921-T is 100% stable under all temperature conditions, lightweight, rigid, and easy to machine.

One of the leading qualifications for Pioneer 921-T's use in vacuum chucks is that it will expand and contract at the same rate of the material being milled. In addition, chucks made from 921-T are extremely lightweight and so rigid that chucks often are merely clamped down rather than bolted.

Of course, where many grooves are concerned, 921-T is ideal. It's easily machined.

Pioneer 921-T is probably the top material available for vacuum chucks.

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DRILL BUSHINGS OUTLAST THEM ALL!

Several factors contribute to the long life of Universal Drill Bushings. blended radius on the top inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests help guarantee their accuracy and uniform quality. Knurled heads provide a quick, sure grip. Available in a complete range of standard sizes and lengths. Orders for special dimensions will receive prompt attention. For complete information, write to the office nearest you — Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis. — or our home office.

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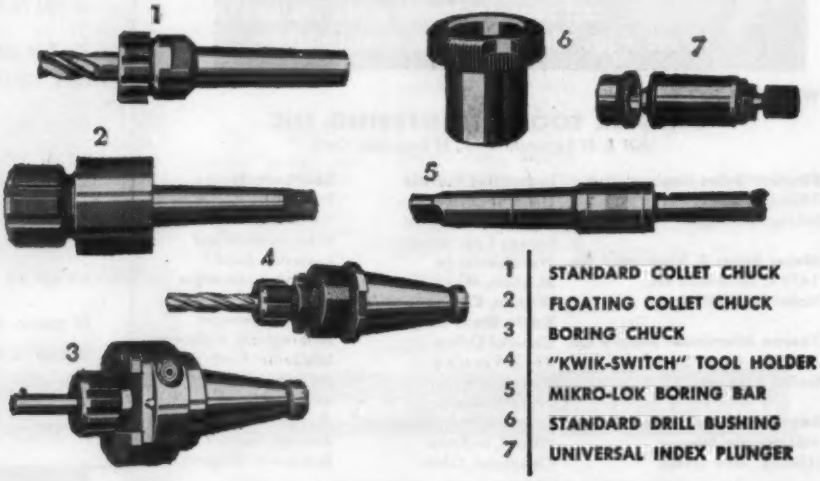

1 STANDARD COLLET CHUCK
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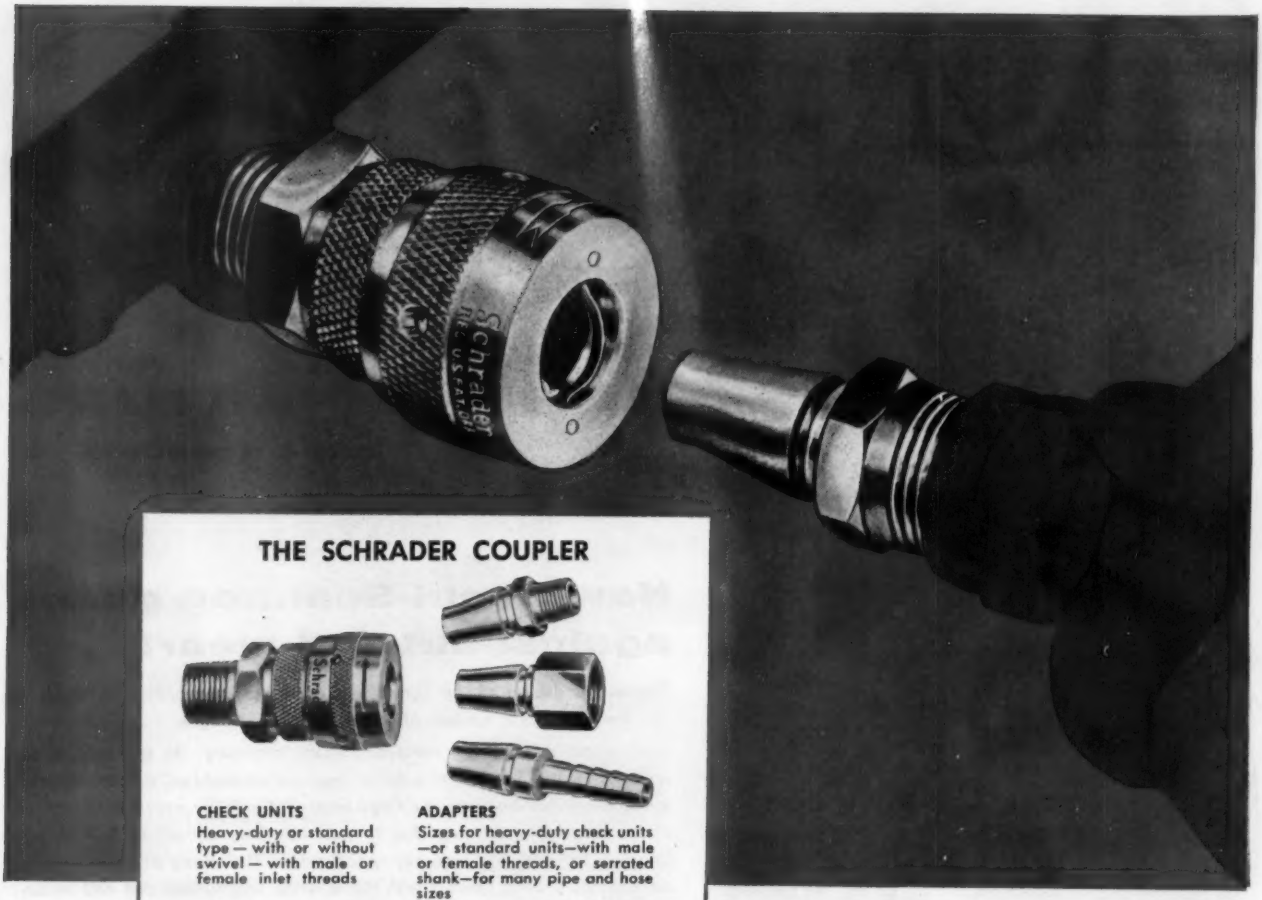
THE SCHRADER COUPLER
CHECK UNITS
Heavy-duty or standard type — with or without swivel — with male or female inlet threads
ADAPTERS
Sizes for heavy-duty check units —or standard units—with male or female threads, or serrated shank—for many pipe and hose sizes

Plug in for air power nearest the job

Spot Schrader Couplers everywhere in your plant—along benches . . . on columns . . . wherever an air outlet means convenience. Schrader Quick-Acting Couplers make air as easy to "plug in" as electric current. Yes, bring air to the job, not the job to the air line—and you'll get greater portability in your air tools . . . eliminate extra lengths of hose and miles of foot steps.

Schrader Couplers are quick . . . they're safe . . . they're sure.

To connect, just push the adapter section into the check unit. Accidental uncoupling is impossible—it takes a positive manual twist of the check unit sleeve to disconnect the coupler and shut off the air.

Make compressed air accessible in your plant, as the largest and most modern plants have done. Schrader Couplers are available in many pipe thread sizes and hose adapters. And remember—Schrader produces a full line of cylinders, valves and other air control equipment, to make your compressed air circuits neat . . . efficient . . . reliable. For details, write today—or fill out the coupon below.

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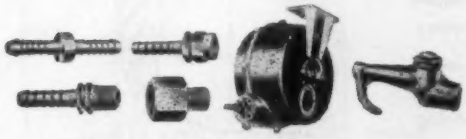

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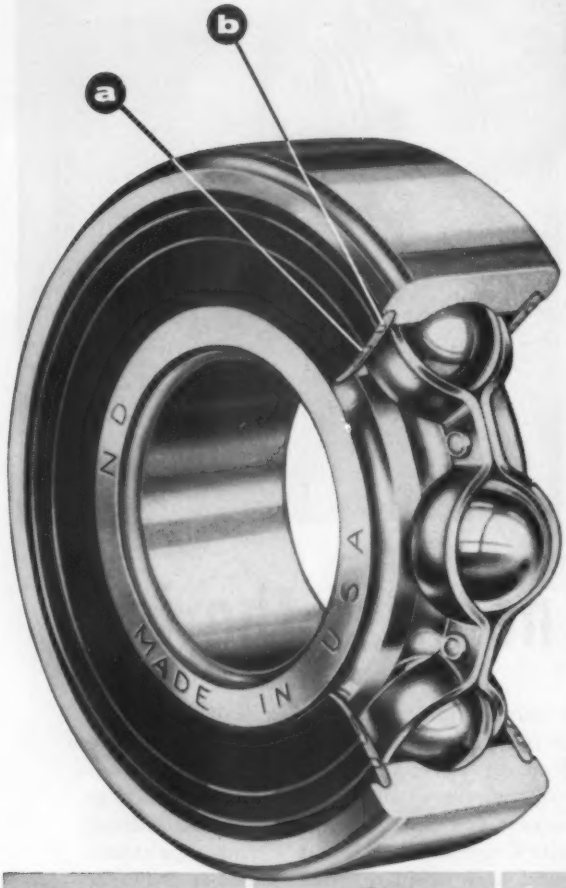
BALL BEARINGS

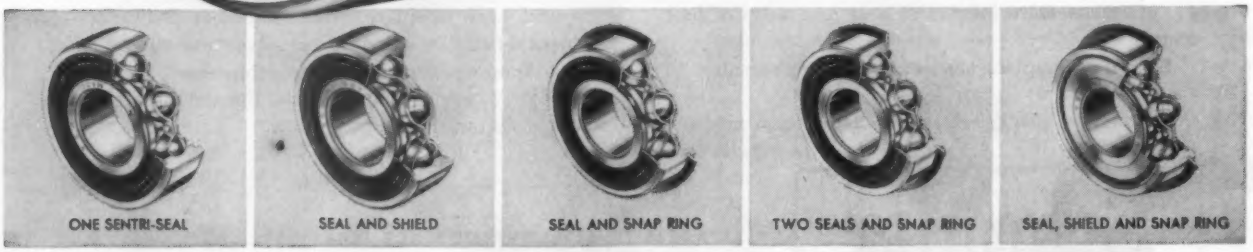


New Sentri-Seal...on guard against dirt and wear!

The unique design of the Sentri-Seal gives optimum protection against dirt, and includes a number of other major advantages.

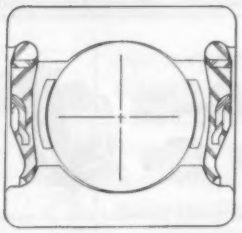
Sentri-Seals are quickly removed, easily replaced. As the seal is of synthetic rubber, in which two metal rings are embedded, a constant-rate spring is created between the rings. Inherent flexibility prevents distortion of the bearing outer ring due to seal insertion, permitting the use of bearings to the higher accuracy specifications. The spring action maintains an efficient sealing contact with the bearing ring to bar dirt and retain lubricant. Sentri-Seals are relatively inert to oils and greases and operate satisfactorily through a temperature range of −40°F to 225°F. Specifications available for still higher temperatures. In applications where relubrication is desired, it is easily accomplished by the injection method.

The New Departure Sentri-Seal basically consists of two separate metal rings, "A" and "B", embedded in synthetic rubber, resulting in a spring which absorbs distortion and deflection. The seal is not drastically influenced by axial displacement due to bearing end-play within prescribed tolerances, and provides efficient sealing at low torque. Bearing shown is equipped with two seals.



The diagram shows in section the New Departure Sentri-Seal. Lip contacting surfaces are form-ground simultaneously with the ball race, giving an extremely high degree of concentricity between sealing surfaces and the raceway.

Sentri-Seal is available for a range of sizes in single-row, standard-width bearings and also in two types of New Departure adapter bearings. Sizes, dimensions and capacities are listed in the latest New Departure catalog.



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A Completely New Machine—

designed especially for

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The MODEL 2B-36

DE VLIEG *SPIRAMATIC* JIGMIL

latest addition to a famous line of Precision Boring and Milling Machines

Model shown is the
NEW 2B-36
***SPIRAMATIC* JIGMIL**
available with
3″ diameter spindle bar
36″ vertical travel
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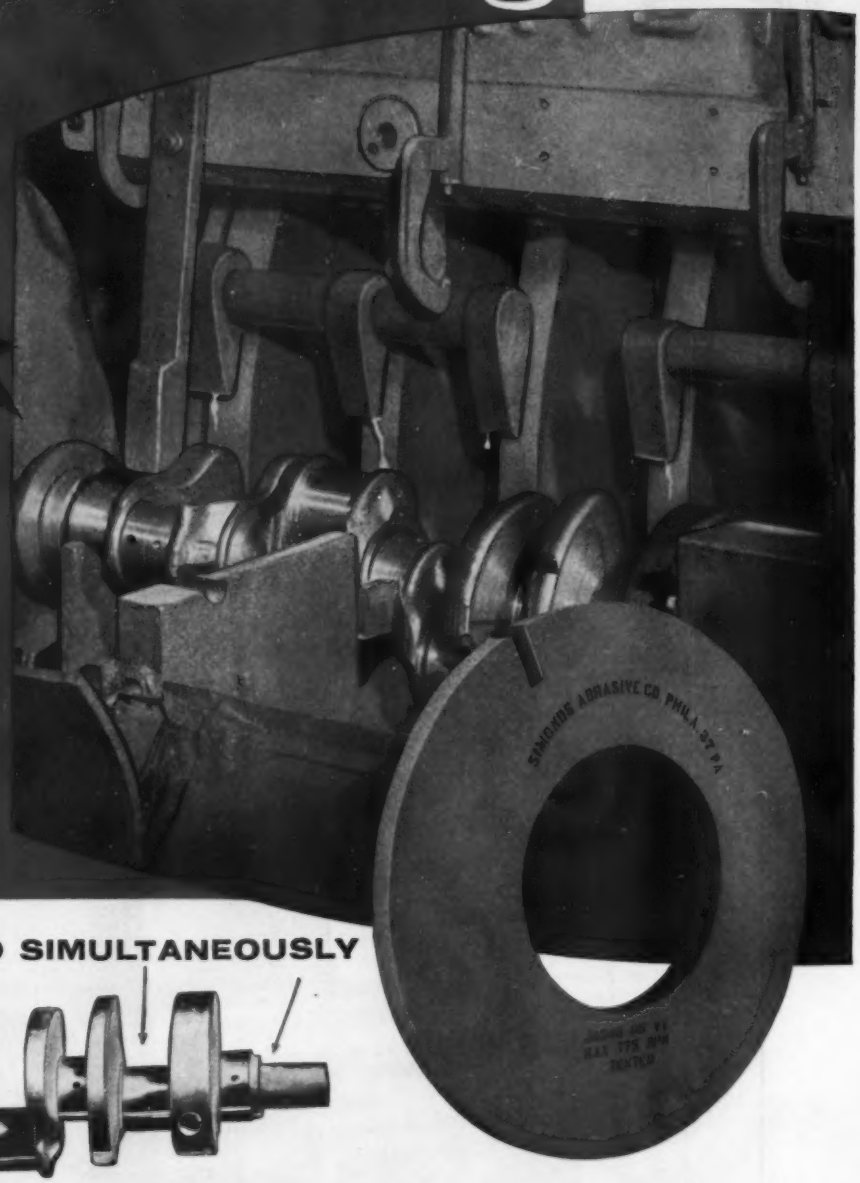
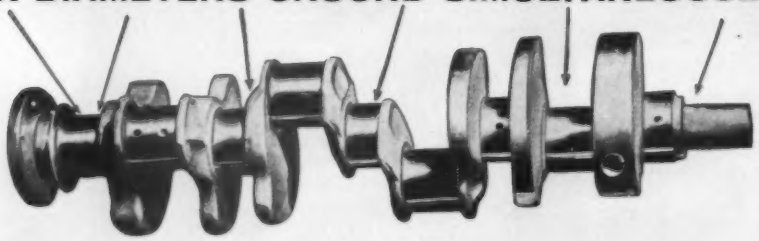
For Multiple Grinding

specify SIMONDS ABRASIVE CO. grinding wheels in MATCHED SETS



SIX DIAMETERS GROUND SIMULTANEOUSLY



The crankshaft grinding operation illustrated here is typical of the production economies possible with "matched sets" of Simonds Grinding Wheels in multiple set-ups.

These wheels are furnished in counterbalanced sets, each wheel identified by set number, and painted on the face with a red stripe for accurate line-up on the spindle. Matched for best balance, these sets give more uniform grinding action, better and more production.

If you grind cylindrical parts requiring more than one diameter, investigate multiple wheel set-ups. A Simonds Abrasive Engineer will be glad to help you in determining the specification and recommended procedures for your job. Write for this service today.

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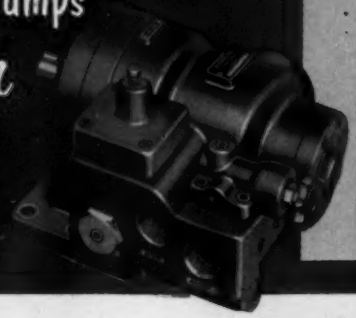

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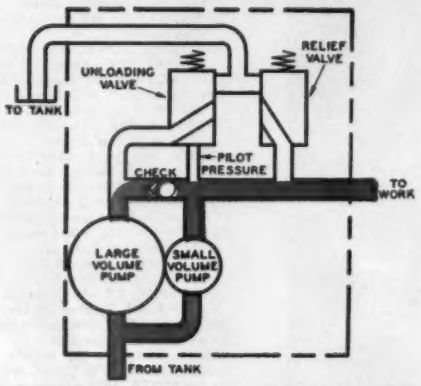

Fig. 1 Combined Delivery of Large and Small Volume Cartridges at Low Pressure

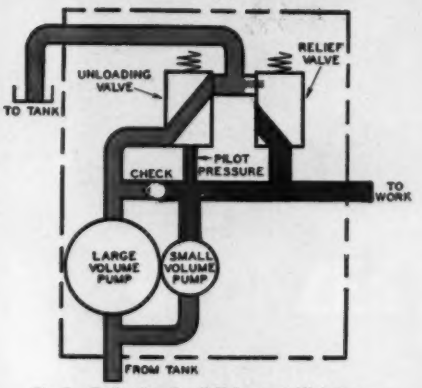

Fig. 2 Delivering Small Volume at High Pressure

Two Vickers Vane Type pumping cartridges are mounted on the same shaft—in the same housing, driven by the same prime mover. One provides a large volume of oil while the other delivers a small volume. These Vickers Two-Pressure Pumps have proved advantageous in a wide variety of applications.

For example, in closing a press or in rapid advance, both pump cartridges work together, supplying maximum volume for quick operation (see Fig. 1). When the press is closed and compression begins, or when the tool goes into feed immediately prior to beginning the cut, the large volume cartridge is automatically unloaded to the reservoir at zero pressure (see Fig. 2). The small volume cartridge alone then provides the lower volume required at high pressure.

These Vickers Two-Pressure Pumps are most economical in power consumption for such two-pressure operation. The reason for this is that a small-volume pump working at full capacity is MORE EFFICIENT than a large-volume pump working at partial capacity. Regardless of momentary delivery, the internal leakage of any pump is proportional to its size and operating pressure. The chart (Fig. 3) shows an interesting comparison between a Vickers Two-Pressure (Two-Volume) Pump and a variable volume vane type pump on a press circuit.

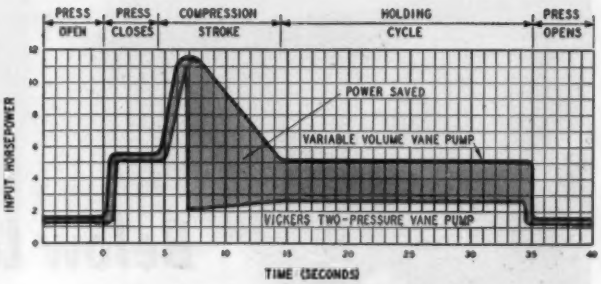

Fig. 3. On this typical press application the saving in power is approximately 50% with a resultant saving in heat in the system.

Like all Vickers Vane Pumps, these two-pressure pumps have the hydraulic balance feature that relieves bearings of all pressure loads (one of the major causes of wear). Cartridge construction enables customer to service in his own plant instead of returning to factory should repairs be necessary. Relief and unloading valves are integral . . . minimizing piping and connections. Complete range of sizes up to 48 gpm. For additional information, ask for Bulletin 54-70a.

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Down Deeper... Below Longer

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Write for new 1955 catalog of Sheldon Machine Tools

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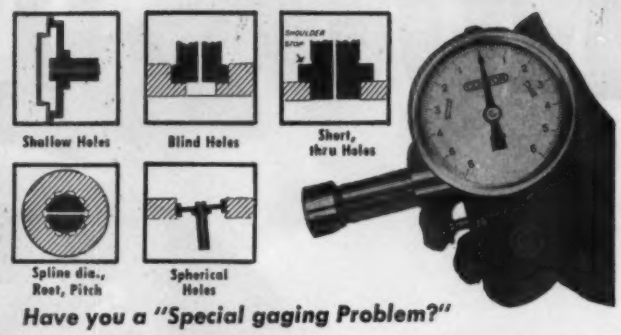

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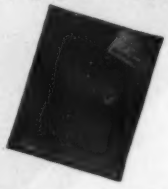

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Stops Losses making Dies and Templates

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DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

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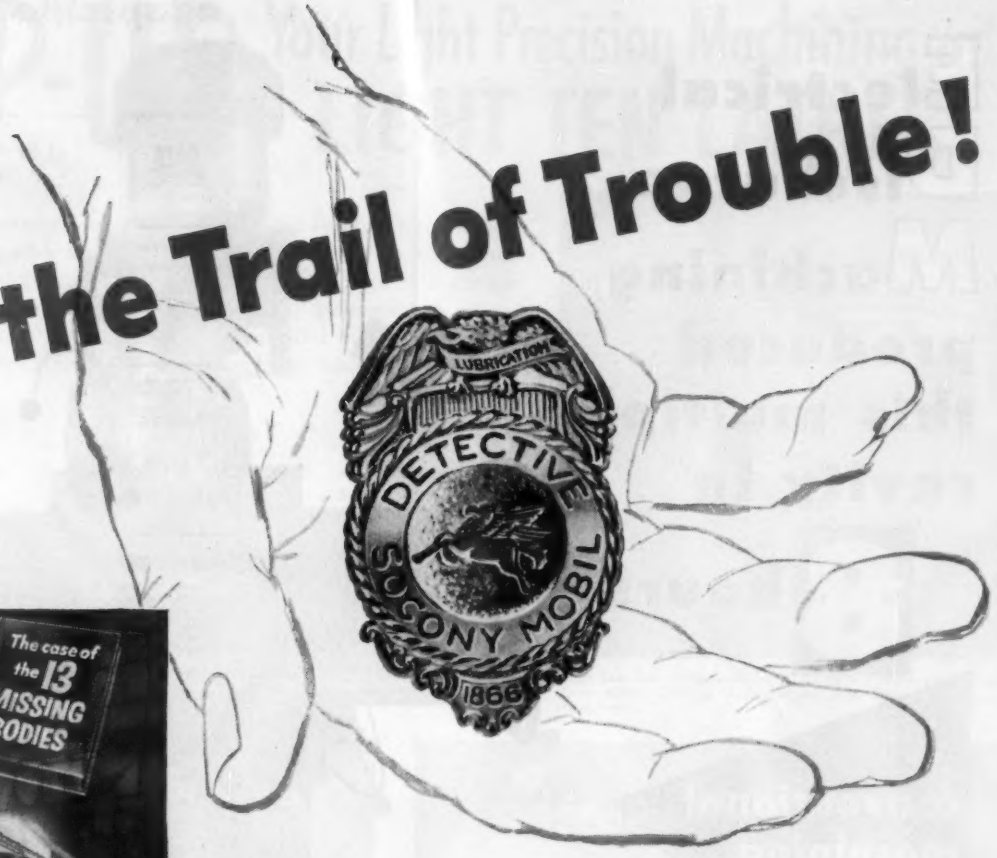
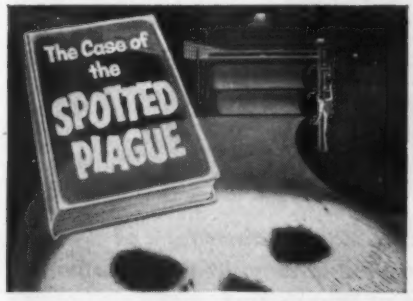


This auto plant had conveyor belt trouble. A Socony Mobil man cured it—saved $1,300 per hour!



Grease spots plagued this large felt mill. A Socony Mobil man ended them—saved $10,000 a year!

These coal miners kept breaking down. A Socony Mobil man stopped this—saved $8,720 annually!

This Flying Red Horse "Sleuth" can solve your problems, too!

His name may be Smith or Jones or Brown. He may be tall or short—blonde, brunette or redhead. But, in each case, he is a master "sleuth"—skillfully trained to track down the culprits that may be robbing your plant of production, material, money.

He is your Socony Mobil man—a lubrication expert who has solved thousands of mystifying cases of trouble in industrial plants. And he has saved plant owners literally millions of dollars with his solutions.

His exploits, in case histories like those reproduced here, are well worth reading—give clues to how he may save money in *your* plant. Now you can read more about him in a special issue of our magazine—"OIL POWER"—just off the press. It will pay you to get a copy. Just write: Socony Mobil Oil Company, Inc., 26 Broadway, New York 4, N. Y.

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Correct Lubrication

FIRST STEP IN CUTTING COSTS

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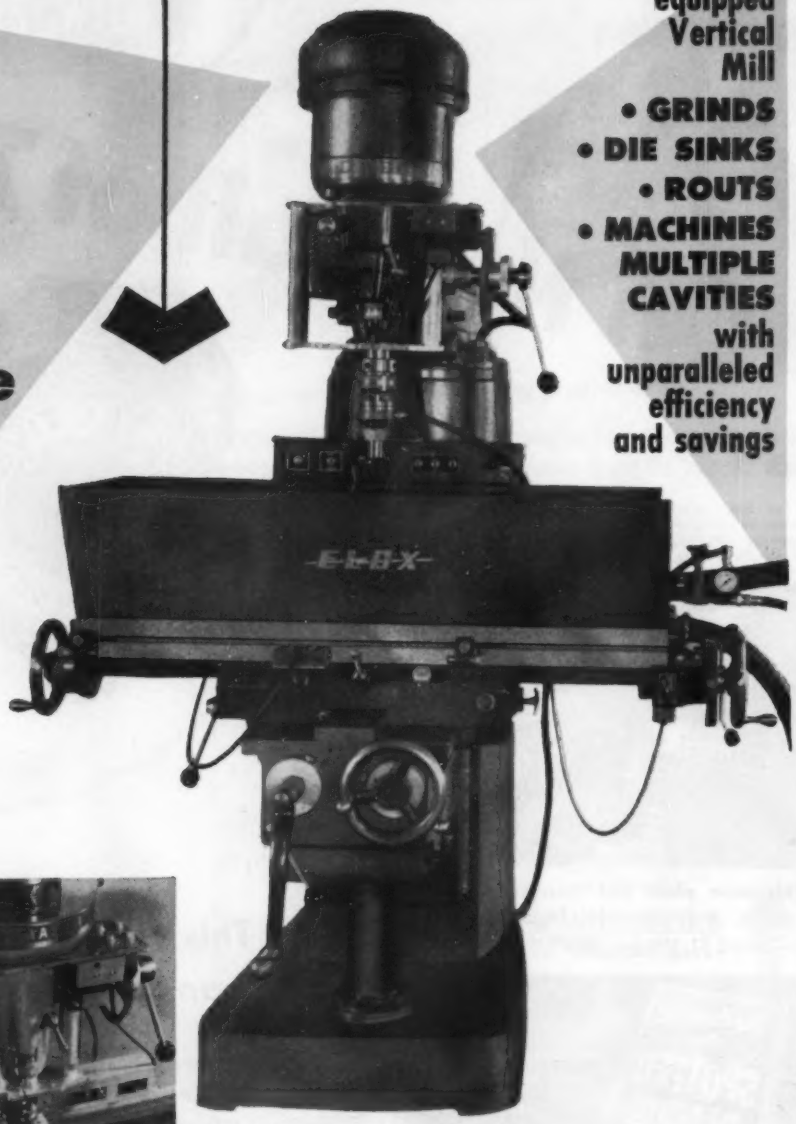
Formerly Socony-Vacuum Oil Company, Inc.

Electrical Discharge Machining produced this multiple cavity in 8 hours

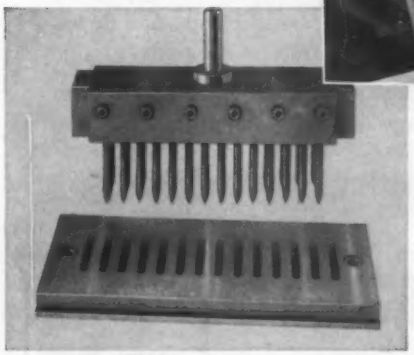
conventional machining time 40 hours

This Elox equipped Vertical Mill

- GRINDS
- DIE SINKS
- ROUTS
- MACHINES MULTIPLE CAVITIES with unparalleled efficiency and savings



Multiple Cavity in coolant retainer tank of Vertical Mill. Machined automatically without operator attention or broach cost.



Finished die and brass electrode. Die Material: Hi Chrome Die Steel. Tolerances: +.0005"—.000 Finish: 15-20 micro inch.

Our engineering staff is always ready to help solve your specific machining problems. Representatives in your area will arrange appointments, at your request, for grinding, die sinking and cavity forming operations at EDM Demonstration Centers.

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STEP-UP Your Light Precision Machining with LIGHT TEN LATHES

Here is a whole series of small lathes designed and built to do your light precision machining. All have the same sturdy construction, the same convenience and ease of operation. There is a choice of 11 models for production, toolroom and maintenance work. Accessories, type of drive, length of bed, and equipment vary. Send for complete catalog and select the lathe which exactly suits your needs.

SPECIFICATIONS

Swing — 10" over bed

Collet Capacity — ⅝" max.

Spindle Bore — $^{27}/_{32}$"

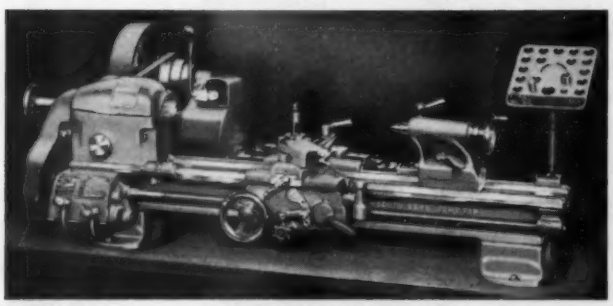
Distances Between Centers
Bench models — 16⅛", 22⅛", 28⅛", 34⅛". Toolroom bench models — 16⅛", 22⅛", 28⅛". Floor Models — 22⅛".

Spindle Speeds (approx.)
12-speed drives — 48 to 1435 r.p.m.
16-speed drives — 52 to 1365 r.p.m.

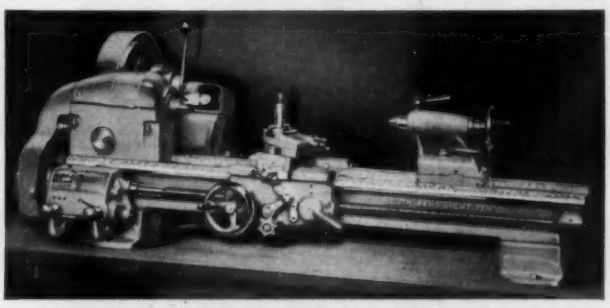
Power Longitudinal Feeds (R.H. or L.H.) Toolroom and Model A — 48, .0015" to .0853". Model B — 26, .0021" to .0155". Model C — 14, .0021" to .0156".

Power Cross Feeds (reversible) Toolroom and Model A — 48, .0004" to .0255". Model B — 23, .0009" to .0046". Cross-feed is hand operated on Model C.

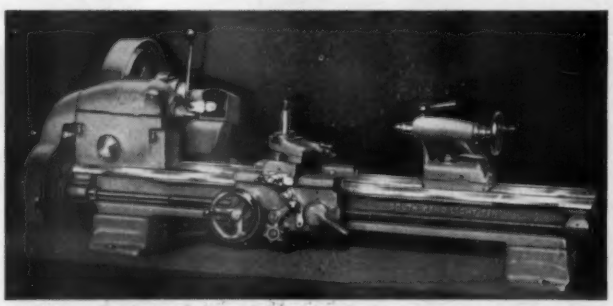
Light Ten Floor Lathe—Model A. 12-speed Underneath Motor Drive—Quick Change Gears. Worm drive apron with power cross-feeds.



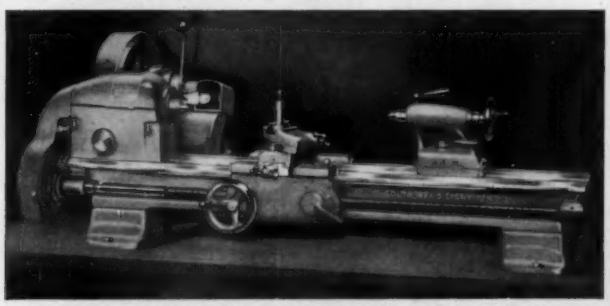
Light Ten Toolroom Precision Bench Lathe. Includes usual toolroom attachments.



Light Ten Bench Lathe—Model A. Quick Change Gears. Worm drive apron with power cross-feeds.



Light Ten Bench Lathe—Model B. Independent Change Gears. Worm drive apron with power cross-feeds.



Light Ten Bench Lathe—Model C. Independent Change Gears. Plain apron with hand operated cross-feed.

Compared with our costs
OUR PRICES ARE LOWER
than they were back in 1941

Prices are closely tied to costs. Costs are still rising. Buy now before increased costs necessitate higher prices.

PLEASE SEND INFORMATION CHECKED:

☐ 9" and 10" BENCH LATHES ☐ 10" to 16-24" FLOOR LATHES ☐ DRILL PRESSES ☐ ½" & 1" Collet TURRET LATHES ☐ TOOL GRINDERS ☐ 7" BENCH SHAPERS

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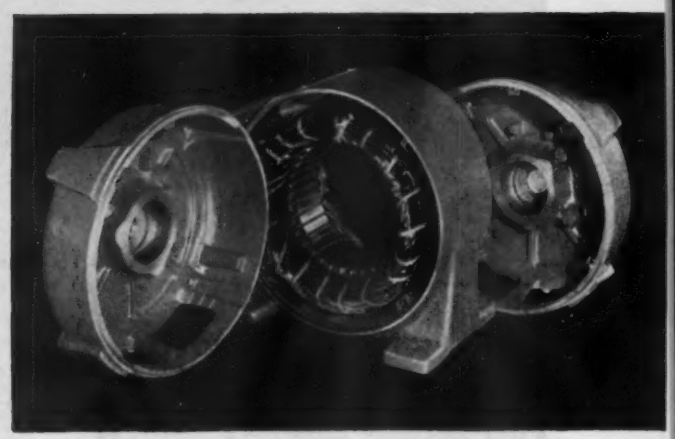
Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

MOTOR FACTS ON INDUSTRY'S
MOST-PREFERRED "POWER PACKAGE"



Electrical System Fact: New fortified insulation includes exclusive Bondar, Bondite and Mylar* for greater protection against the toughest operating conditions.

*Du Pont registered trade-mark

FACT:

The new Life-Line A has stronger insulation than any other motor on the market

Meaning what? Simply that the new Westinghouse Life-Line® "A" motor with new fortified insulation can withstand heavier overloads and operate at higher temperatures than any other motor you can buy.

Similar design advances in the mechanical and lubrication systems make Life-Line "A" industry's most preferred motor.

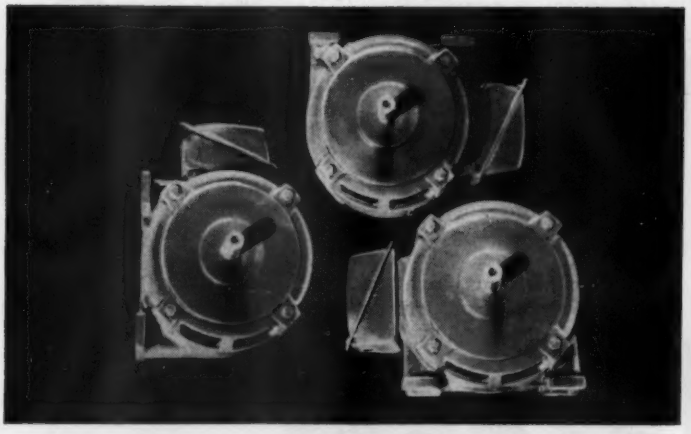
It takes the right combination of *all three systems*—electrical, mechanical and lubrication—to build the best package of power on the market.

Get all the facts by calling your Westinghouse sales engineer . . . *The Man With The Facts!*

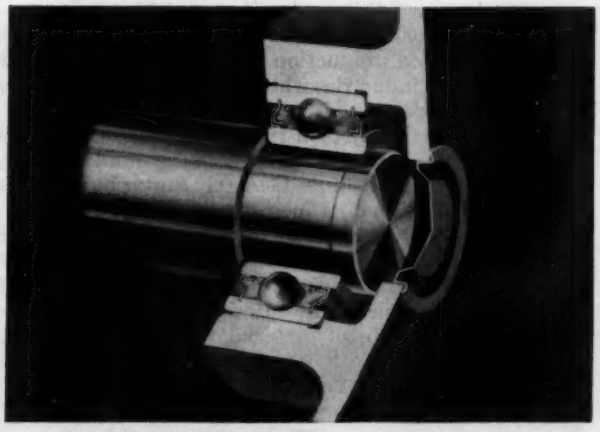
J-21877

YOU CAN BE **SURE**...IF IT'S

Westinghouse



Mechanical System Fact: New cast-iron housing on both drip-proof and totally-enclosed types. Ventilation openings only in end brackets make the motor drip-proof whether mounted on floor, ceiling or wall.



Lubrication System Fact: New "4-way sealed", pre-lubricated bearing eliminates completely the 3 main causes of bearing failure: 1) contamination, 2) over greasing, 3) wrong grease.

At Detrex Corporation, Detroit, workman slips a snug fitting Johnson Bronze Bearing into place on the shaft of an idler arm of this compact Rotary Gyro Degreaser. Idler arms move in "ferris wheel" motion to rotate heavy baskets filled with parts to be degreased.

How Detrex Prevents A Maintenance Problem With Johnson Bearings

The Detrex Corporation, Detroit, manufactures a full line of unique, automatic degreasers, washers, drycleaning and other equipment to speed production, save time and money for many industries where removing oil and grease from parts and materials is a problem.

On the idlers of the totally enclosed Rotary Gyro Degreaser shown being assembled above, Johnson Bronze General Purpose Bearings give years of trouble-free service.

As a Detrex executive puts it: "When we sell a machine we want the customer to forget about shut-downs to repair some trivial part that's failed, so we design every part, choose every piece of material with one thought in mind: make it better to last longer. It's the reason we have specified Johnson Bronze General Purpose Bearings wherever bearings of this type will do the job."

Detrex depends upon a Johnson distributor in that area for service on their bearing requirements. They have found his stocks to be adequate to meet their requirements and know that even in emergencies the bearings they need will be delivered when they want them.

Johnson General Purpose Bearings are available from stock in over 900 sizes. Alterations such as oil grooves, slots, or holes are easily and quickly made. They are cast in Johnson's famous, high grade bearing bronze alloy No. 72. For complete information on prices and delivery, call your Johnson distributor. Johnson Bronze Co., 515 South Mill Street, New Castle, Pa.

Johnson Bearings

GRAPHITED
over 175 sizes

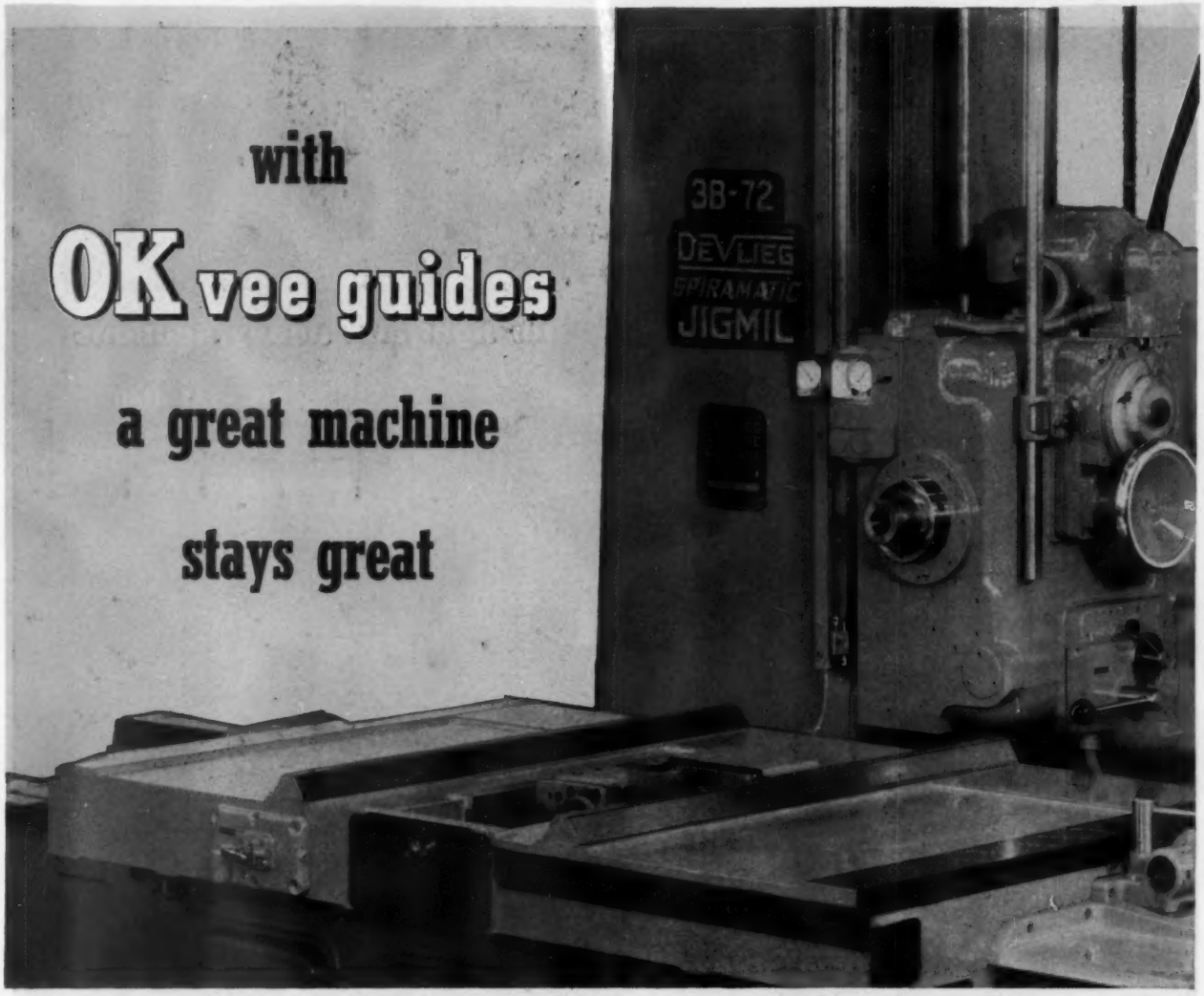
GENERAL PURPOSE
over 900 sizes

UNIVERSAL BRONZE BARS
over 400 sizes

LEDALOYL
over 400 sizes

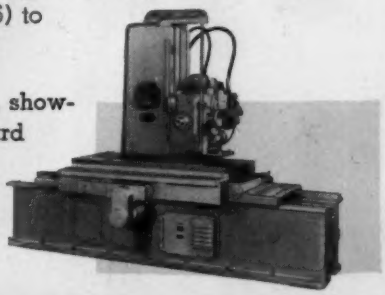
ELECTRIC MOTOR
over 350 sizes

with OK vee guides a great machine stays great

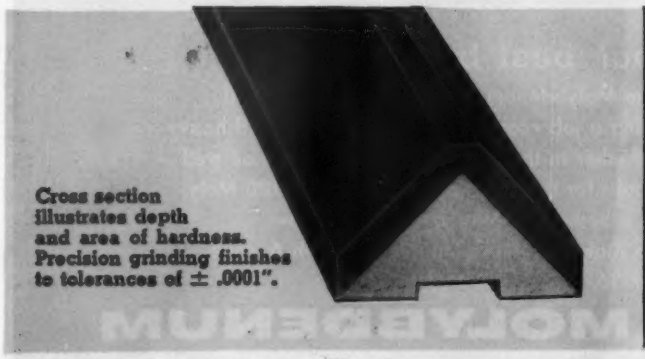


THE DeVLIEG MACHINE CO. has been a consistent user of OK Hardened Products for many years. They build absolute precision into their line of boring and milling machines. One of the methods of achieving this ultra-precision throughout the life of their machines is with OK hardened vee guides as illustrated in this exposed photo of their Spiramatic Jigmil.

Here's why OK hardened vee guides contribute to machine tool accuracy: They are virtually wear-proof, a result of welding special analysis tool steel to a mild steel backing. High wear-resistant properties are produced by special hardening (Rockwell C-65-66) to a depth of 3/16"



For Free bulletin, showing seven standard cross sections in over 60 sizes, write Dept. 45-W

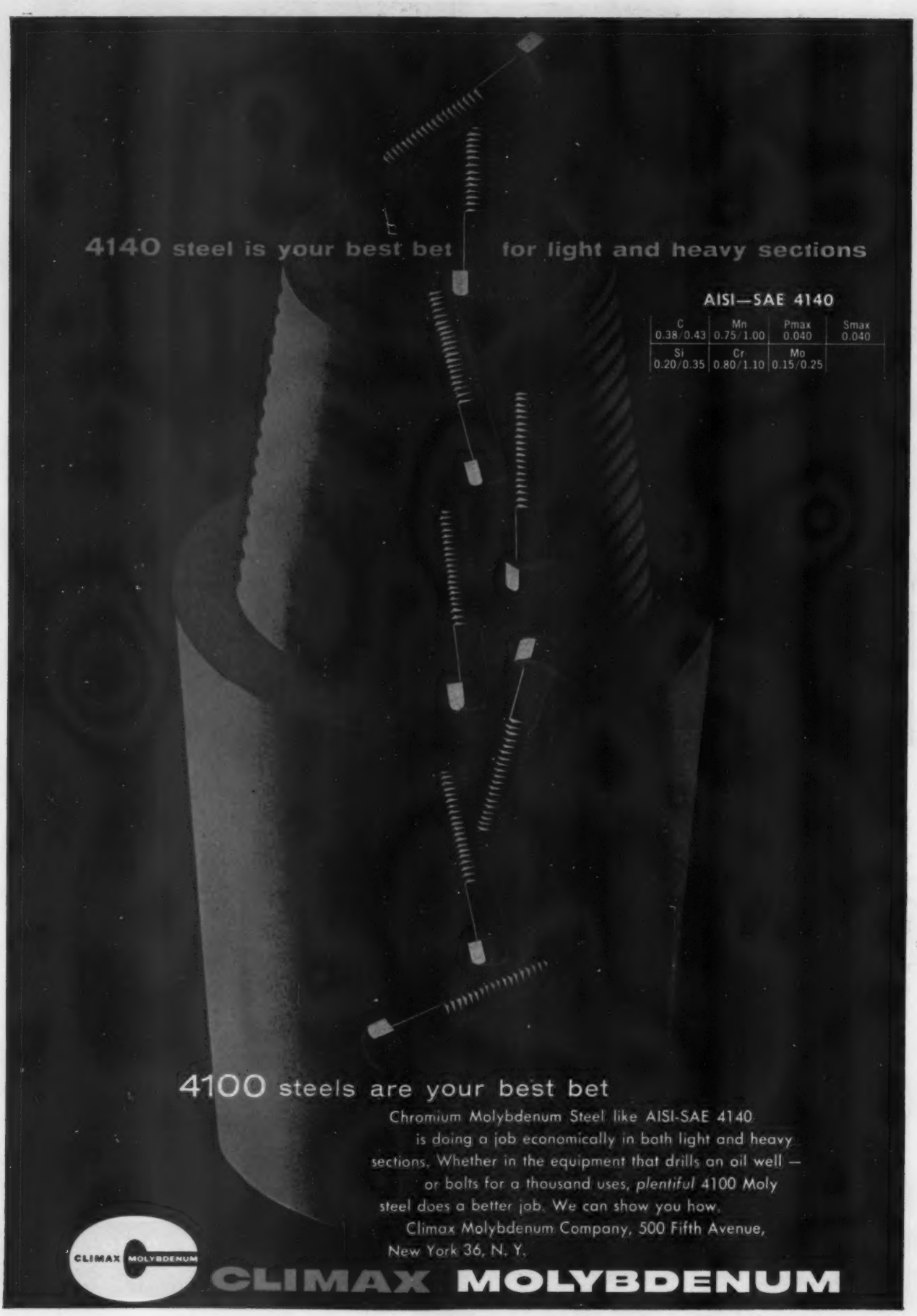


Cross section illustrates depth and area of hardness. Precision grinding finishes to tolerances of ± .0001".

Hardened Ways • Slitter Knives • Shear Blades
Cut-off Blades • Hardened Spacers • Gibs • Ball Races
Work-rest Blades • Wear Strips • Bronze Ways

THE OHIO KNIFE CO.

CINCINNATI 23, OHIO


4140 steel is your best bet
for light and heavy sections
AISI—SAE 4140
C 0.38/0.43
Mn 0.75/1.00
Pmax 0.040
Smax 0.040
Si 0.20/0.35
Cr 0.80/1.10
Mo 0.15/0.25
4100 steels are your best bet
Chromium Molybdenum Steel like AISI-SAE 4140
is doing a job economically in both light and heavy
sections. Whether in the equipment that drills an oil well —
or bolts for a thousand uses, plentiful 4100 Moly
steel does a better job. We can show you how.
Climax Molybdenum Company, 500 Fifth Avenue,
New York 36, N. Y.
CLIMAX MOLYBDENUM
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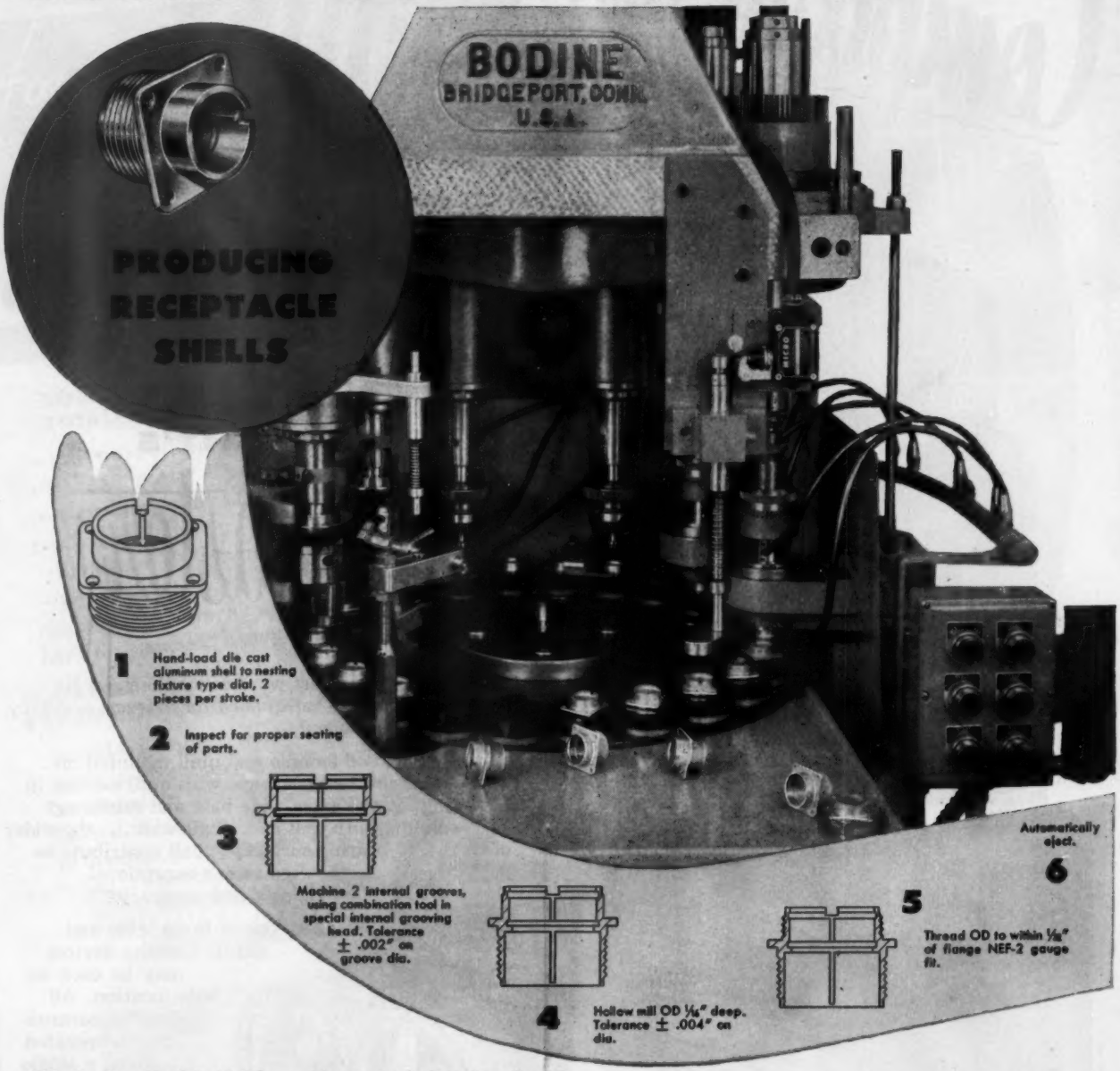
Bodine CASE HISTORY NO. 38


PRODUCING RECEPTACLE SHELLS
BODINE
BRIDGEPORT, CONN.
U.S.A.
1 Hand-load die cast aluminum shell to nesting fixture type dial, 2 pieces per stroke.
2 Inspect for proper seating of parts.
3 Machine 2 internal grooves, using combination tool in special internal grooving head. Tolerance ± .002" on groove dia.
4 Hollow mill OD ⅛" deep. Tolerance ± .004" on dia.
5 Thread OD to within ⅛" of flange NEF-2 gauge fit.
6 Automatically eject.

This Bodine Model 48-30 machine is tooled to handle 13 receptacle shells ranging from 7/16-27 to 1⅝-18 NEF 2 threads. Shells are used for multiple terminals in TV, Radar, etc.

PRODUCTION: From 1,600 to 2,200 pieces per 50-minute hour, depending on size of shell.

Potentiometers next to push button station regulate two electronically controlled variable speed motors. Positive, accurate control over spindle rpm and over rate of feed gives lead-screw accuracy to the threads with a non-reversing spindle.

Bodine machines (of four types) may be tooled for an extremely wide variety of high speed repetitive production jobs . . . including drilling, tapping, threading, screw inserting, light milling, and assembly. For a true picture of cost cutting, write Dept. AM-10 for our brochure "Bodine Presents 12 Typical Case Histories."

"You Can't Meet Tomorrow's Competition with Yesterday's Machine Tools."

THE Bodine CORPORATION
BRIDGEPORT CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

6BD54

Compare this latest jig borer for capacity accuracy speed!

KNIGHT'S New Jigmaster

Last word in medium size jig borers—unequalled for extreme accuracy, capacity, increased output.

The totally enclosed spindle and quill mounted on super-precision ball bearings, with quill moving in a solid bearing . . . the extra-wide base and reinforced column, both cast as a single unit . . . the wider bearing surfaces . . . all contribute to the Jigmaster's exceptional rigidity and accuracy.

Any one of three table and saddle locating devices may be used for hole location. All machine controls can be operated from a single convenient location.

Write For Complete Information

SPECIFICATIONS

Table Size	18" x 24"
Table Travel—Longitudinal	20"
—Cross	15"
Vertical Capacity	23"
Throat	20"
Weight	7500 Lbs.

KNIGHT VERSATILE MILLERS ACCURATE · RIGID

W. B. KNIGHT MACHINERY CO. • 3920 WEST PINE BLVD. • SAINT LOUIS 8, MO.

for time-saving, money-saving

POWER DISTRIBUTION

SQUARE D
TOTALLY ENCLOSED FEED-IN DUCT

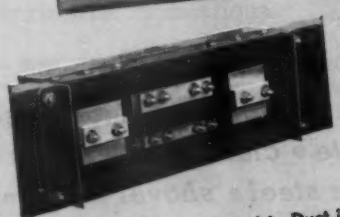
is the most efficient way to transmit large amounts of power. It provides the lowest known voltage drop—only 1.8 volts per 1000 amperes per 100 feet.

Exclusive design requires no ventilation—permits a totally enclosed, compact, dust-excluding enclosure. Rigid construction provides high resistance to heavy electrical stresses.

SQUARE D
EXPANSION CONNECTED PLUG-IN DUCT

provides flexible power distribution for branch circuits. Machinery can be rearranged quickly at minimum cost. Plug-in units can be attached at frequent intervals along the length of the duct, providing power where it's needed, when it's needed.

BUSWAY FEATURES PROVE DESIGN LEADERSHIP



NEW JOINT DESIGN. Feed-in Duct joint design saves installation time and reduces maintenance cost. Duct ends are identical—unnecessary to select mating ends before positioning or hanging duct sections. Outward-facing, pre-installed bolts permit rapid assembly and easy maintenance.

ROUND BUS BARS for Plug-in Duct provide greater mechanical strength and resistance to short-circuit stresses. Circuit breaker or fusible type plug-in units are easily installed at 2-foot intervals along both sides of the duct. Plug-in stabs grip the round bus bars with exceptionally high pressure.

EXPANSION CONNECTORS of laminated copper join bus bars between sections—permit proper alignment, insure tight joints and provide for expansion and contraction at Plug-in duct joints. All bolt heads face outward for greater accessibility.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

WHENEVER you need
SPECIAL STEELS
for special purposes
check first with
Ingersoll

• carbon electric steel for tank clutch discs • alloy steels • armor plate • clutch plate steels • tillage steels • soft center steel • shovel steels • knife steels • saw steels, including high speed hack saw blade steels • Tem-Cross steel • heat-resisting steels • stainless steels • IngAclad stainless-clad steel • forging quality electric steel ingots

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Ingersoll STEEL DIVISION

Borg-Warner Corporation • NEW CASTLE, INDIANA

A new dimension in motors!

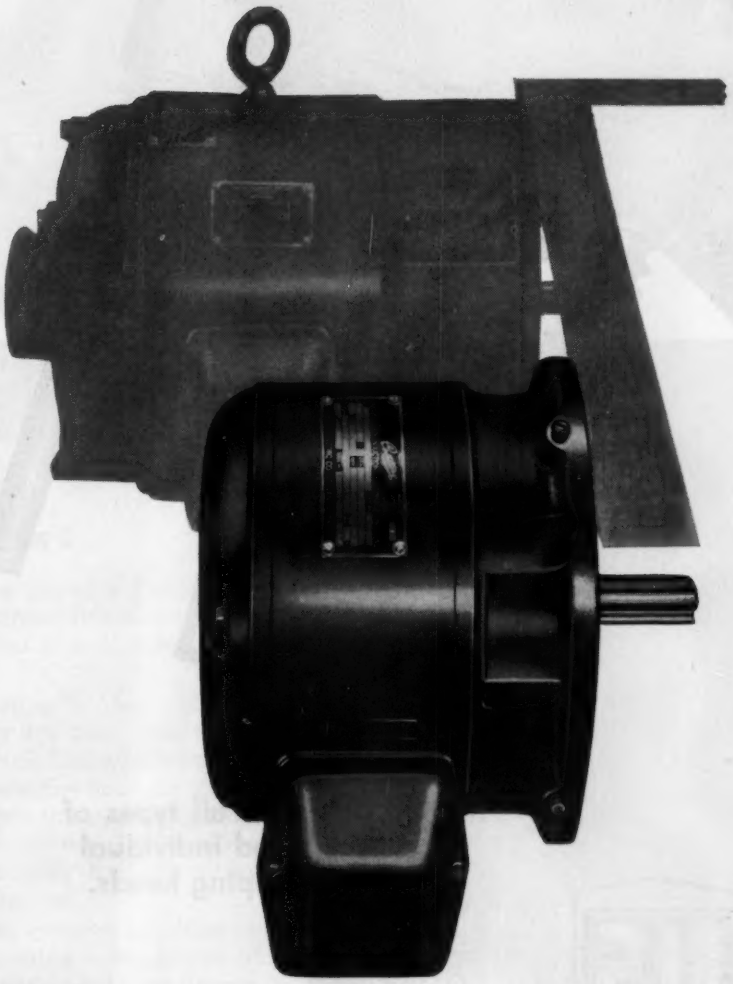
SHORTER Century **Performance Rated© MOTORS**

SAVE SPACE...
SAVE WEIGHT

This new line of shorter, round-frame, end-mounted motors by Century can give you greater freedom in design and engineering. They meet modern demands for compactness and weight-saving ... with even better performance.

No special mountings are required! These shorter Century motors have full-size NEMA "D" flanges. They are interchangeable with all other popular makes of standard end-mounted motors. The shorter motors are available in sizes from 1 to 15 H.P... in open or totally enclosed fan-cooled frames . . . for vertical or horizontal applications.

For full data, call your nearest Century Sales Office.



Performance Rated©
MOTORS
⅛ to 400 H. P.

CENTURY ELECTRIC COMPANY

1806 PINE ST., ST. LOUIS 3, MO. • *Offices and Stock Points in Principal Cities*

You are missing a bet!

Use U.S. DRILL HEADS with Turret Lathes...

Write Today for Latest Catalog

Multiple Spindle Drill Heads have many uses, yet oftentimes they are not considered as being applicable to automatic turret lathes.

If you want to reduce labor costs and the number of operations required to complete a particular part, why not see how U. S. Drill Head engineers can help you.

Write or wire us today. There's no obligation, of course, and the chances are that we can save you time and money.

Manufacturers of all types of fixed center and individual lead screw tapping heads.

US HEADS

Since 1915

UNITED STATES DRILL HEAD CO.

616-618 Burns Street, Cincinnati 4, Ohio

dag DISPERSIONS®

Put life insurance on your forging dies!

The most critical period in the life of a forging die is its first few hours of use. Longer life is assured if adequate and proper lubrication is available during the break-in period.

Treat your dies with 'Aquadag'®—'dag' Colloidal Graphite in water—*before* they are used. This forms a microscopically thin and smooth film which assures necessary lubrication and reduces the need for operational lubricants. Also, it protects the surface against corrosion during storage prior to use. One forging plant increased die life 90% merely by pretreating its steel forging dies with 'Aquadag'.

Superior forging lubricants, either water-base or oil-base, can be prepared by adding a dispersion of 'dag' Colloidal Graphite to conventional die lubricants. 'dag' dispersions provide better parting, improved lubricity, and greater heat resistance; they also reduce lubricant costs, scrap losses, and die failure.

Write today for Acheson's free literature on forging lubricants. Ask for Bulletin No. 426-Q3.

Dispersions of molybdenum disulfide are available in various carriers. We are also equipped to do custom dispersing of solids in a wide variety of carriers.

ACHESON COLLOIDS COMPANY
PORT HURON, MICHIGAN
...also ACHESON COLLOIDS LIMITED, LONDON, ENGLAND

use 'dag' dry films for trouble-free lubrication

OK carbide cutter facemills push-rod faces of cylinder head for world's most powerful piston aircraft engine

OK CARBIDE CUTTER, ON CINCINNATI VERTICAL FINISH-MILLS RIGHT ANGLES OF INTAKE AND EXHAUST PUSH ROD FACES, OF PRATT & WHITNEY AIRCRAFT WASP MAJOR ENGINE CLIMB-MILLING ONE AND CONVENTIONAL-MILLING THE OTHER

THE close tolerances specified by the aircraft industry are a challenge to the "world's most modern milling cutters" and the "world's most modern milling machines."

The picture shows one of thousands of milling machine operations. Note the tilting fixture which makes possible face and periphery milling, of both sides of the cylinder head.

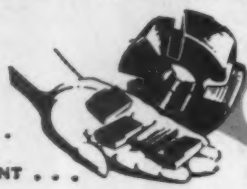
OK carbide milling cutters are widely used in the aircraft industry because they have the necessary stamina . . . *more beef* in the body, pack *more blades* for finishing cuts, *heavier blades* for *roughing* cuts. They put more finished pieces on the floor, day after day.

Blades are simple wedge-shaped blocks. (The wedge is world's strongest mechanical device). Blades once set, cannot move. Mated serrations prevent tipping and slipping, provide a scale for blade advancement to compensate for wear, reduce grinding to less than .005" per blade on cutters in which the fine adjustment feature is incorporated. No locks, blocks, screws, pins or gibs are needed.

Write for OK Tool Catalogs

"MODERN MILLING CUTTERS FOR MODERN MILLING MACHINES"
"AMERICA'S FIRST SYSTEM OF SINGLE POINT TOOLS"

TWO COMPONENTS—
BODY AND BLADES
SIMPLE . . .
STRONG . . .
SUFFICIENT . . .



OK

modern milling cutters for modern milling machines

THE OK TOOL COMPANY INC., Milford, New Hampshire

Typical application for Atlantic cutting oils, showing a Barber-Colman milling machine.

NEW ATLANTIC cutting oils

for high production on tough jobs

Here at last is really effective help in keeping production high in your milling, turning, and drilling departments.

With these new Atlantic non-soluble cutting oils, you can maintain high production rates without the handicap of foul odors on hot tough jobs. Work is visible right through the oil. And the oils are compatible when blended—even down to the heaviest grades. Operators like these new oils better too, because they don't indelibly stain hands or clothing.

Get complete information on these new oils and your copy of the Atlantic Cutting Oil Selection Chart. Learn about this superior measure for cutting oil efficiency . . . determined by performance rather than chemical composition. Write your nearby Atlantic office listed below, or The Atlantic Refining Company, 260 South Broad St., Philadelphia 1, Pa.

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LUBRICANTS • WAXES
PROCESS PRODUCTS

PROVIDENCE, R. I. 430 Hospital Trust Bldg.
SYRACUSE, N. Y. Salina and Genesee Sts.
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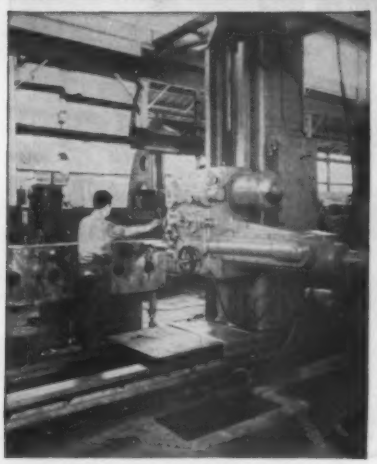
PITTSBURGH, PA. Chamber of Commerce Bldg.

Horizontal Drilling Machines by Kaukauna AT WORK....



Performing quick, accurate drilling operations on press frame parts—drilling, fixture boring, tapping operations on milling machine columns—drilling all four parts of a tractor frame on a repetitive production line basis—these are the types of jobs illustrated, showing Kaukauna Horizontal Drilling Machines at work. The time and labor savings are of course apparent—elimination of expensive crane lifts, reduction in handling time, inexpensive tooling.

As illustrated, there is a Kaukauna Horizontal Drilling Machine in a size suitable for any class of work from small, high production jobs to extremely large work pieces. These extremely versatile machines make for greater work simplification and may be used to advantage in your shop for driving boring fixtures, drilling, reaming, boring, counterboring, tapping and spot-facing operations.

Kaukauna builds Universal Radial Drills and Horizontal Drilling Machines in a range of sizes which meet practically all requirements in modern production practice. Write today for descriptive catalog or ask representative to call.

KMC Kaukauna MACHINE CORPORATION
KAUKAUNA, WISCONSIN, U. S. A.

RUGGED PRECISION LATHE

Harrison 11" GAP-BED GEARED HEAD PRECISION LATHE

- 24" between centers (also available in 40" centers)
- 11⅜" swing over ways • 4½"x18¾" swing in gap
- 1¼" collet capacity • Pre-loaded Timken bearings
- Threaded or American taper spindle too • Clutch & brake

With 2 H.P. motor, controls, steady and follow rests, face plate, driver plate, cabinet base and chip pan

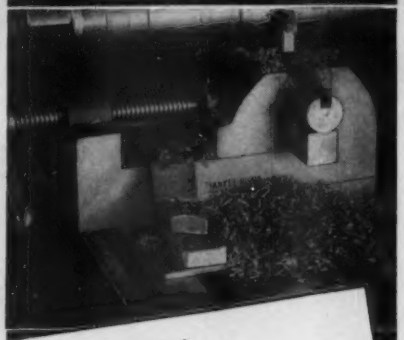
AMAZING LOW PRICE F.O.B. N.Y.C. $1495.

Made by T. S. Harrison and Sons Ltd., one of England's foremost manufacturers of fine machine tools. Send for catalog and price list.

Also 15" swing lathe with outstanding features, including spindle bored to pass 3" diameter bar.

ACCESSORIES AND PARTS MAINTAINED BY U.S. REPRESENTATIVE • Stanley Sheppard • 30 CHURCH ST. N.Y. 7
AVAILABLE THROUGH YOUR DISTRIBUTOR

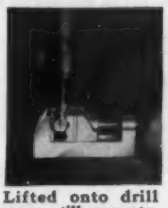
"YANKEE" VISES



Give *Start-to-finish* work holding

Off the swivel base, end down for accurate marking.

Back on the swivel base, at the bench, for center punching.



Lifted onto drill press, still accurately in position.

Held in same position but moved to milling machine.

Take a job through every step without a misstep . . . faster, easier . . . in a "Yankee" Vise. Work lined up accurately from bench to drill press, to milling machine and back to bench. Lifts off and on a swivel base at the bench. Vise squared on top, bottom, sides and front end for machine work. Easily made into handy, economical jig. Hardened steel block, V-grooved, provided with each "Yankee" Vise. Four sizes, with and without swivel base . . . 1½", 2", 2¾", and 4" jaw widths. Your industrial distributor carries the full line. **"Yankee" Tool Book FREE!**

NORTH BROS. MFG. CO.
200 West Lehigh Ave.
Philadelphia 33, Pa.

"YANKEE" TOOLS NOW PART OF STANLEY
THE TOOL BOX OF THE WORLD

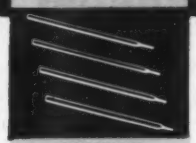
America's most complete line of arc-welding equipment and electrodes.

AC WELDERS
Sizes up to 625 amps. All connectable to 220 or 440 volts—550 volts on request.

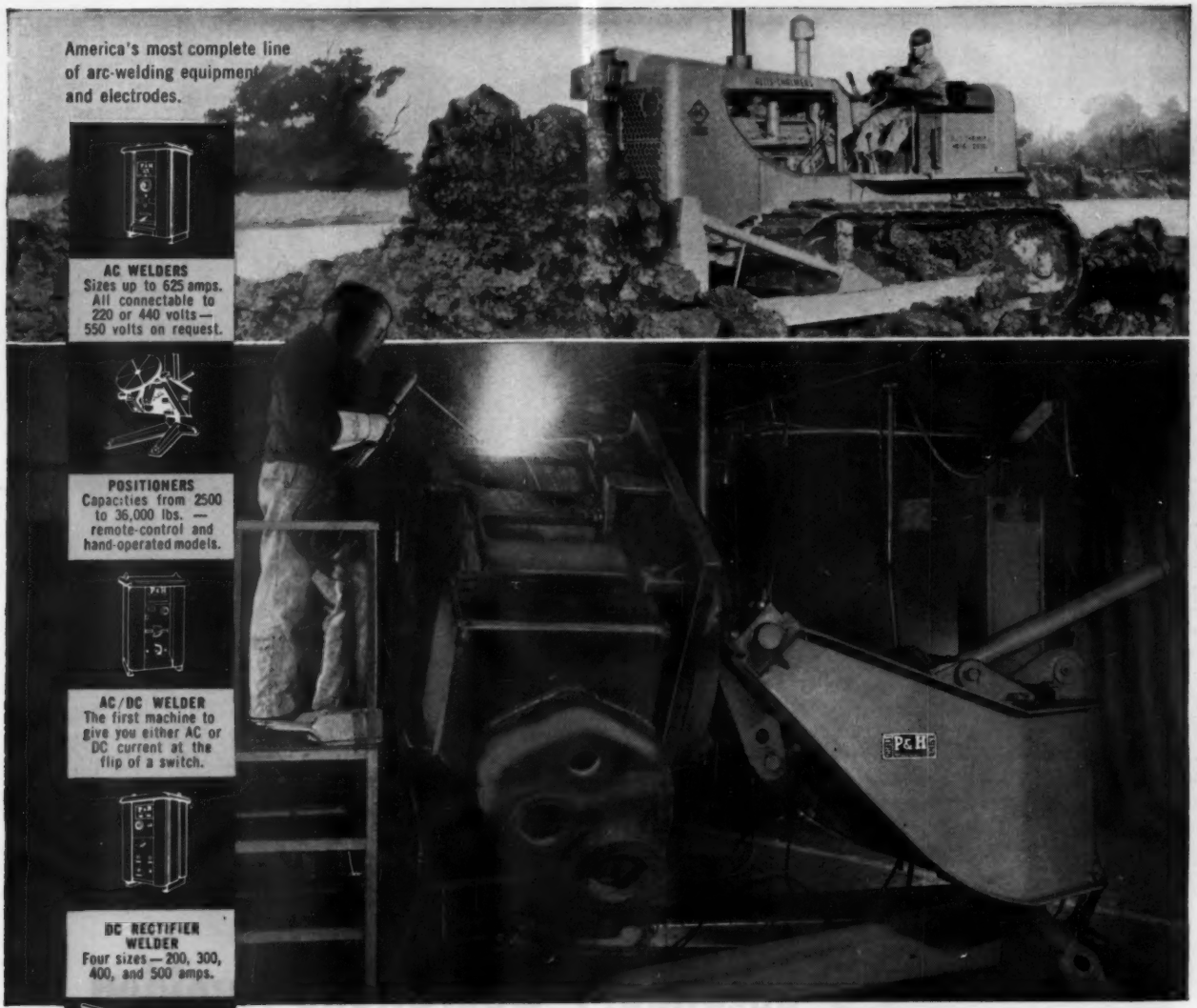
POSITIONERS
Capacities from 2500 to 36,000 lbs. — remote-control and hand-operated models.

AC/DC WELDER
The first machine to give you either AC or DC current at the flip of a switch.

DC RECTIFIER WELDER
Four sizes—200, 300, 400, and 500 amps.



ELECTRODES
For mild steel, cast iron, "hard-to-weld" steels, stainless steels, hard surfacing.



P&H Positioner doubles tractor-housing production for Allis-Chalmers

...and there's a size and model that can save you money, too

Ten years ago Allis-Chalmers installed a P&H Welding Positioner at its Springfield, Illinois Works, to position 3000-lb. tractor drive-housings for welding. It's been racking up quite a record ever since. Without adding any other labor-saving equipment, production of welded housings has been doubled. Here's what A-C engineers say:

"Quality has been improved and manufacturing costs reduced. Production of welded housings has been increased approximately 100% over previously-used methods. Daily labor and overhead savings of $87.30 have been realized."

There's no mystery about it. A P&H Welding Positioner can cut your welding costs up to 60%, because it reduces fatigue and waste motion. A pushbutton rotates, tilts, and moves the piece vertically, for economical downhand welding all the way through. And because weldors always weld in a downhand position, they deposit metal up to twice as fast.

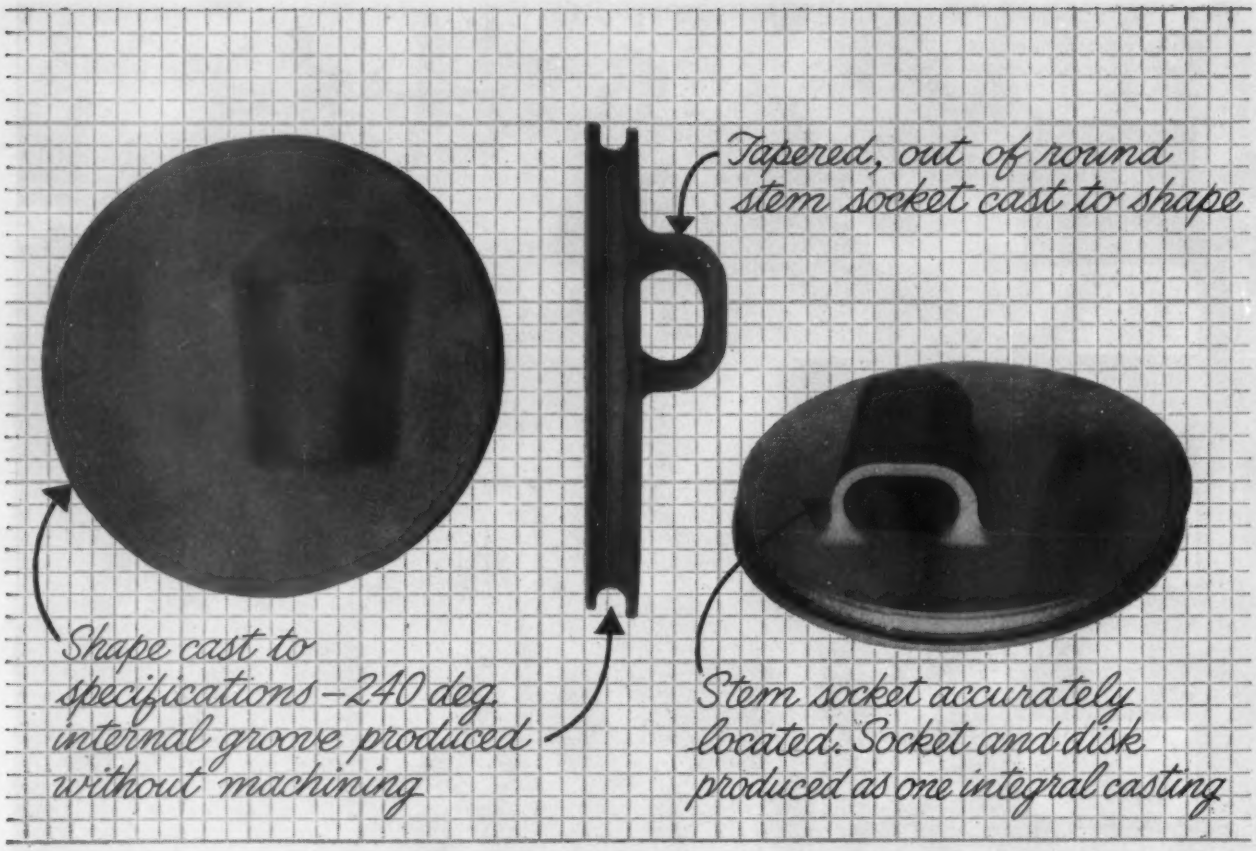
P&H Welding Positioners have many exclusive features. Ask your P&H representative or distributor about them. Or write for our latest bulletin to the Welding Division, Harnischfeger Corporation, 4514 W. National Ave., Milwaukee 46, Wisconsin.

2887

HARNISCHFEGER

the P&H Line

P&H welding equipment is manufactured and sold in Canada by REGENT EQUIPMENT MANUFACTURING COMPANY LTD., 455 King Street West • Toronto, Ontario, Canada


Tapered, out of round stem socket cast to shape
Shape cast to specifications—240 deg. internal groove produced without machining
Stem socket accurately located. Socket and disk produced as one integral casting

Investment-Cast in One Piece . . . 5 Secondary Operations Avoided

This intricate valve disk and stem socket were investment cast at a considerable saving in machining, assembling, and joining costs. The disk is produced in an odd shape and has a concave rim with a 240-degree groove. There is a tapered, out-of-round recess in the stem socket. The disk and socket were designed and produced as one integral casting.

The shape of the disk, vital to the proper functioning of the part, was cast to size. A contour machining operation would have been required to produce this shape by other methods. The groove in the rim of the disk, and the stem socket, were also cast to size . . . thus eliminating two more difficult machining operations.

An assembly operation, which would have required precision locating devices, was also avoided. The stem socket had to be accurately located . . . 0.225 in. from the centerline of the disk. This location was held to within plus or minus 0.005 in. on the finished part by the investment-casting method.

Reducing production costs by eliminating secondary operations is only one of the many advantages of HAYNES' precision-investment-casting process. For the full story call or write to any of the District Sales Offices listed below:

HAYNES TRADE-MARK ALLOYS

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

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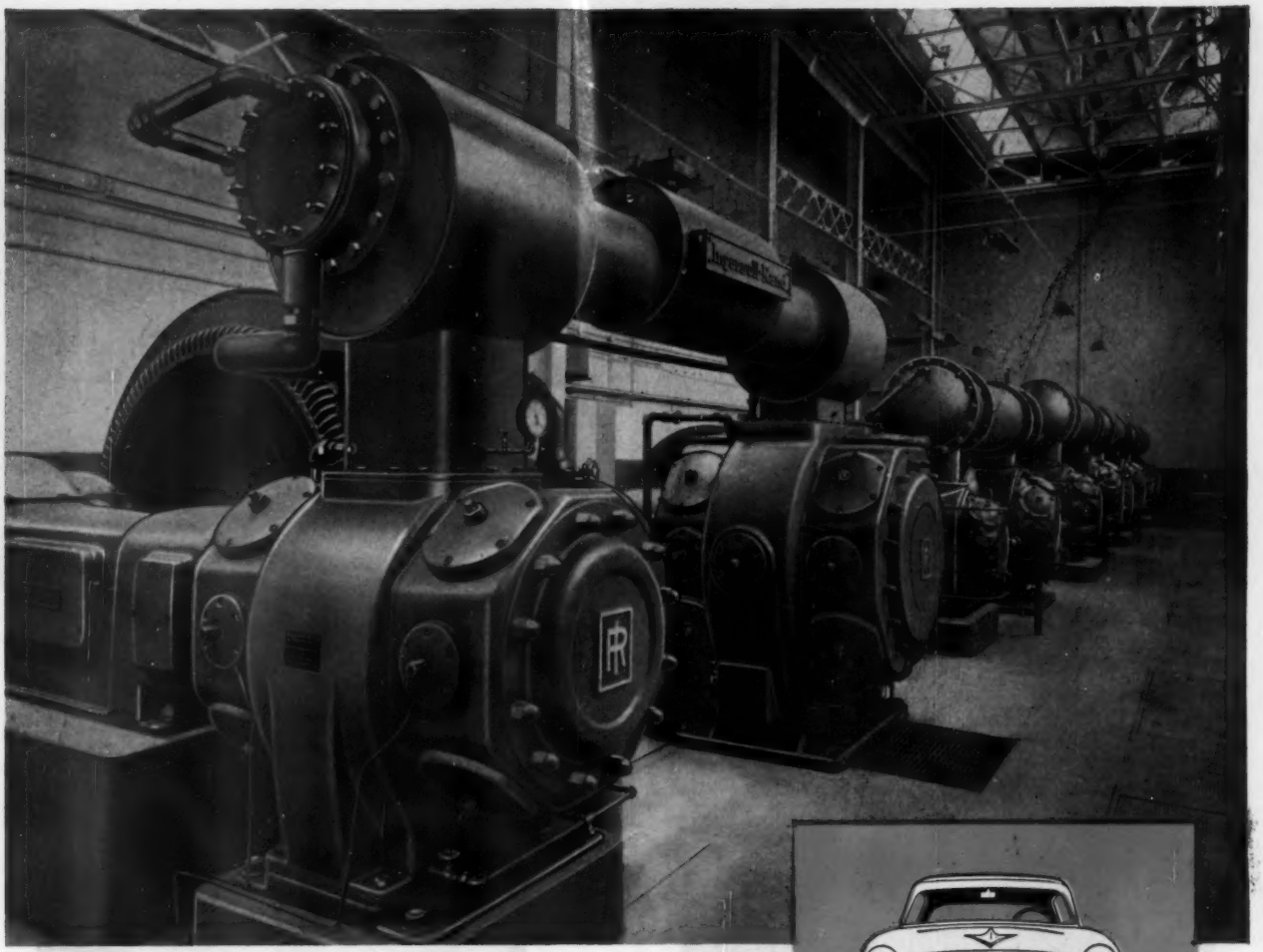

Streamlined Air Power Plant

behind the streamlined NEW HUDSON

Modernized compressor room at Hudson Division of American Motors simplifies operation and maintenance

AT Hudson, improvement of plant and product go hand-in-hand.

Here, the compressed air plant previously consisted of one steam- and four electric-driven compressors, in three different locations. The old steam-driven unit, which had out-lived its value as a dependable standby, was replaced by a new Ingersoll-Rand 3,000 cfm PRE compressor. All five electric-driven compressors were then installed in a single building, with receivers and aftercoolers in the basement directly below. This compact installation is shown above, with the new PRE unit in the foreground. The four other compressors are also Ingersoll-Rand PRE units. Although more than 25 years old, they were found to be in such excellent running condition throughout that there was no need for replacement.

Wherever you need thoroughly dependable, low-cost air power, it pays to specify Ingersoll-Rand. Your I-R representative will be glad to show you why—and give you full details on any type of air or gas compressor. Helping you is his business!

Ingersoll-Rand

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COMPRESSORS • CONDENSERS • AIR & ELECTRIC TOOLS • PUMPS • ROCK DRILLS • GAS & DIESEL ENGINES

New! Revolutionary!

Colonial
ONE-WAY
Surface
Broacher

"Eliminates" Return-Stroke
"Eliminates" End of Stroke
"Doubles" Length of Stroke

For complete information on the new Colonial ONE-WAY surface broacher, ask for Bulletin VC-55.

MECHANICAL DRIVE
AC MOTOR
VARIABLE SPEED
HYDRAULIC OR
MECHANICAL FIXTURES
CARBIDE OR
HSS BROACHES
NO PIT REQUIRED
FOR LOW CEILING
LONGER TOOL LIFE

EXTREME ACCURACY
GUARANTEED
STROKE LENGTH
UP TO 200 INCHES
SPEEDS UP TO 50 FEET/MIN.
ONE LONG STROKE—
ONE PART
OR
MULTIPLE SHORT STROKES
ON MULTIPLE PARTS
CONTINUOUS OPERATION

PIONEERS OF H.S.S. BROACHING
COLONIAL
BROACH & MACHINE CO.
DETROIT 13, MICH.

UNIFIED BROACHING is the key to successful broaching

CLEVELAND WORM AND GEAR COMPANY SHOWS HOW

McCaskey Control System Cuts Tool and Operating Costs

Operating costs went down and efficiency went up when the Cleveland Worm and Gear Company started using McCaskey Tool Crib Control.

Mr. *Edward Mason, Tool Engineer* of Cleveland Worm and Gear and its affiliate, the Farval Corporation, gives the lowdown:

> "In both companies, your system revealed we were overstocked on little-used tools and understocked on some in regular use. And since installing McCaskey controls we have practically eliminated emergency tool orders even though a large part of our worm and gear production is custom-made.
>
> It has helped us increase the number of tools available without additional purchases by preventing employee hoarding. The installation of the McCaskey Tool Location Board has reduced production delays. Now tools are seldom lost or misplaced and waiting at the crib window has been eliminated.
>
> You have helped us cut down on breakage. McCaskey *Broken Tool Reports* are analyzed as an indication of trouble and unusual breakage is reported to the proper department."

McCaskey Tool and Gage Controls and other Control Systems can offer you comparable benefits. What kind would be best for your operation? Send coupon today for full details.

Find out how McCaskey can help you regardless of your plant size or products. MAIL COUPON TODAY!

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • TOOLS • MAINTENANCE • COSTS

Division of

VICTOR ADDING MACHINE CO.

Manufacturers of Business Machines, Cash Registers, Business and Industrial Systems, Electronic Equipment, Electri-Cars.

3900 N. Rockwell Street **Chicago 18, Illinois**

Victor Adding Machine Company
McCASKEY INDUSTRIAL DIVISION
3900 North Rockwell Street
Chicago 18, Illinois

Please send me your new booklet, "How Tool Costs Were Cut 12 Ways in 20 Plants".

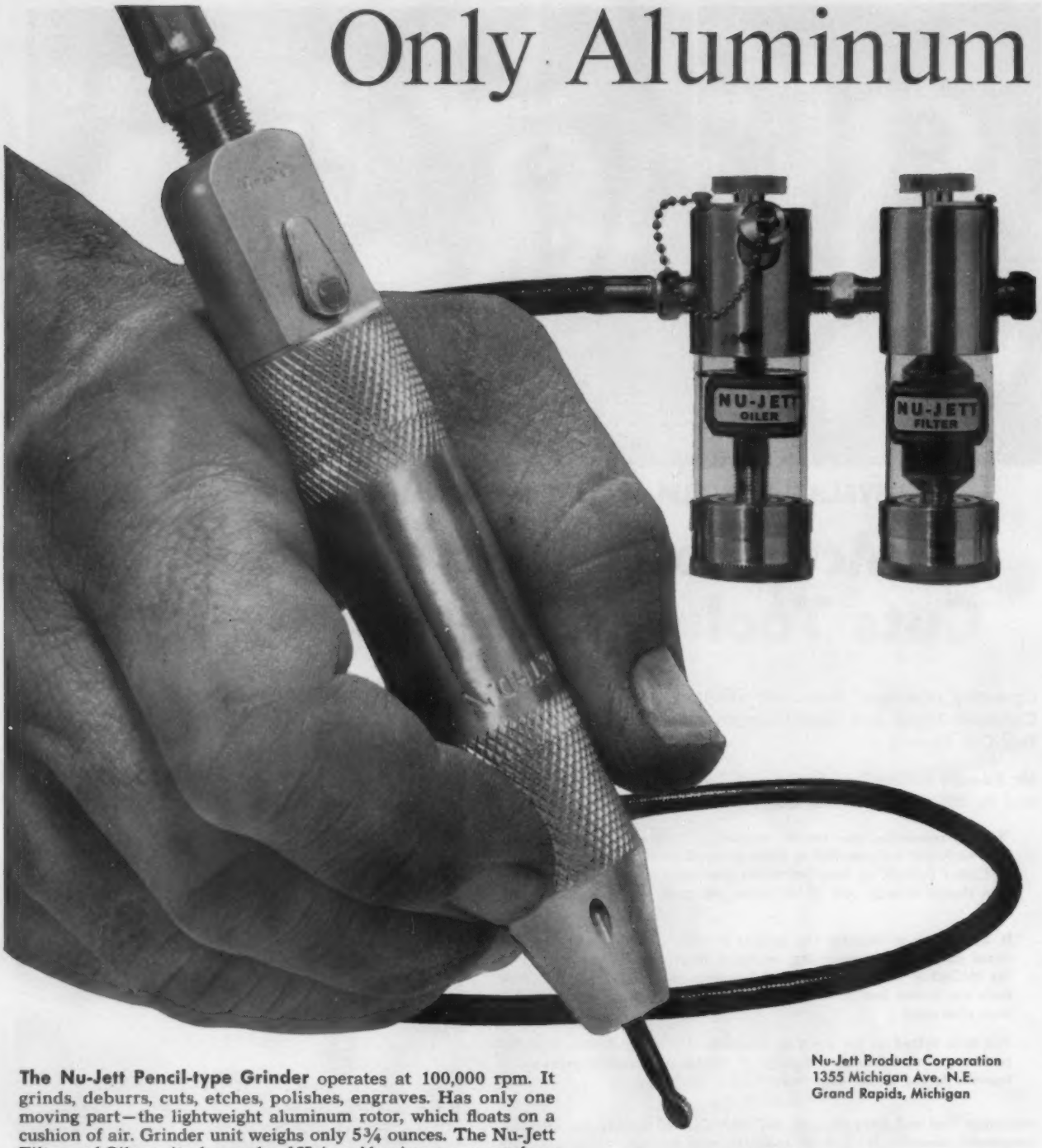
Name.....

Position.....

Company.....

Address.....

Only Aluminum



The Nu-Jett Pencil-type Grinder operates at 100,000 rpm. It grinds, deburrs, cuts, etches, polishes, engraves. Has only one moving part—the lightweight aluminum rotor, which floats on a cushion of air. Grinder unit weighs only 5¾ ounces. The Nu-Jett Filter and Oiler unit, also made of Kaiser Aluminum, assures clean air for the grinder, simultaneously with accurately metered oil in mist form. Units are perfect example of how Kaiser Aluminum makes possible high quality, precision products at reasonable cost.

Nu-Jett Products Corporation
1355 Michigan Ave. N.E.
Grand Rapids, Michigan

GENERAL MANAGER OF NU-JETT, Mr. William W. Peterson, says:

"Aluminum saved us 27% in costs! Aluminum's lower initial cost was a big factor in this saving. But it also provided other important savings. Its light weight gives us appreciable savings in shipping costs, including the lighter weight shipping container. Brass would have required a clear baked enamel for protection. Steel could not be considered for this product because compressed air, which runs the tool, carries moisture which would quickly rust the metal.

"One more thing: machined aluminum gives the Nu-Jett grinder a quality that puts it in a class by itself."

parts are good enough for this amazing grinder!

BECAUSE of the high performance and quality requirements of the Nu-Jett pencil-type grinder, made by the Nu-Jett Products Corporation, Grand Rapids, Michigan, *only* aluminum screw machine parts could be successfully used.

Nu-Jett found that Kaiser Aluminum was the perfect material for their grinder and filter unit. It was not only economical in raw material outlay and production costs but actually *permitted a design of higher performance characteristics!*

DESIGN ENGINEER OF NU-JETT, Mr. Charles V. Johnson, says:

"Aluminum made this grinder possible! Obviously, a pencil-type grinder that has a speed of 100,000 rpm and yet is extremely durable makes metal selection of paramount importance. In every way, aluminum was superior to other metals. The light weight aluminum rotor attains maximum rpm within 4 seconds, thus minimizes starting lag. Too much lag would result in the rotor turning in the critical vibration zone long enough to cause excessive wear on the bearings. Once started, the light aluminum rotor actually floats in the air stream. By using aluminum for virtually every part, we make the tool easy to use, with less operator fatigue.

"Aluminum's anodic finish is more resistant to the attack of salt-laden hand moisture. These, of course, are only a few of the many rewarding design experiences we have had with Kaiser Aluminum."

SCREW MACHINE FOREMAN AT NU-JETT, Mr. Arthur Moorhus, says:

"Aluminum speeds our production! In the first place, we have no difficulty in machining aluminum at the same speeds and feeds as brass, and often faster. We use conventional tools and tool angles for aluminum. It's easier to handle and feed into the Automatics because it's so much lighter. We find that *Kaiser* Aluminum Rod runs extremely uniform and we like it as well as any other metal to machine."

THE Nu-Jett story is just one of many that emphasize this point: *you can recommend aluminum parts with confidence.*

This can mean more business for you because you can usually offer a *lower bid* in aluminum, often with better quality. Even when specifications call for another material you should always offer a bid in aluminum.

Remember that you get *three times* as many parts from a pound of Kaiser Aluminum stock as from a pound of brass or steel. That's why each part can cost far less!

In addition, Kaiser Aluminum stock often permits other important economies that help you offer lower bids: It eliminates expensive plating. It extends tool life. It reduces cleaning costs, because lightweight aluminum chips easily "float" from cavities. And its light weight greatly reduces shipping charges and cuts the cost of material and process handling.

For more information or assistance, look for our local number in the classified telephone directory under the heading "Aluminum" or contact one of our many distributors. Kaiser Aluminum & Chemical Sales, Inc. *General Sales Office,* Palmolive Bldg., Chicago 11, Illinois; *Executive Office,* Kaiser Bldg., Oakland 12, California.

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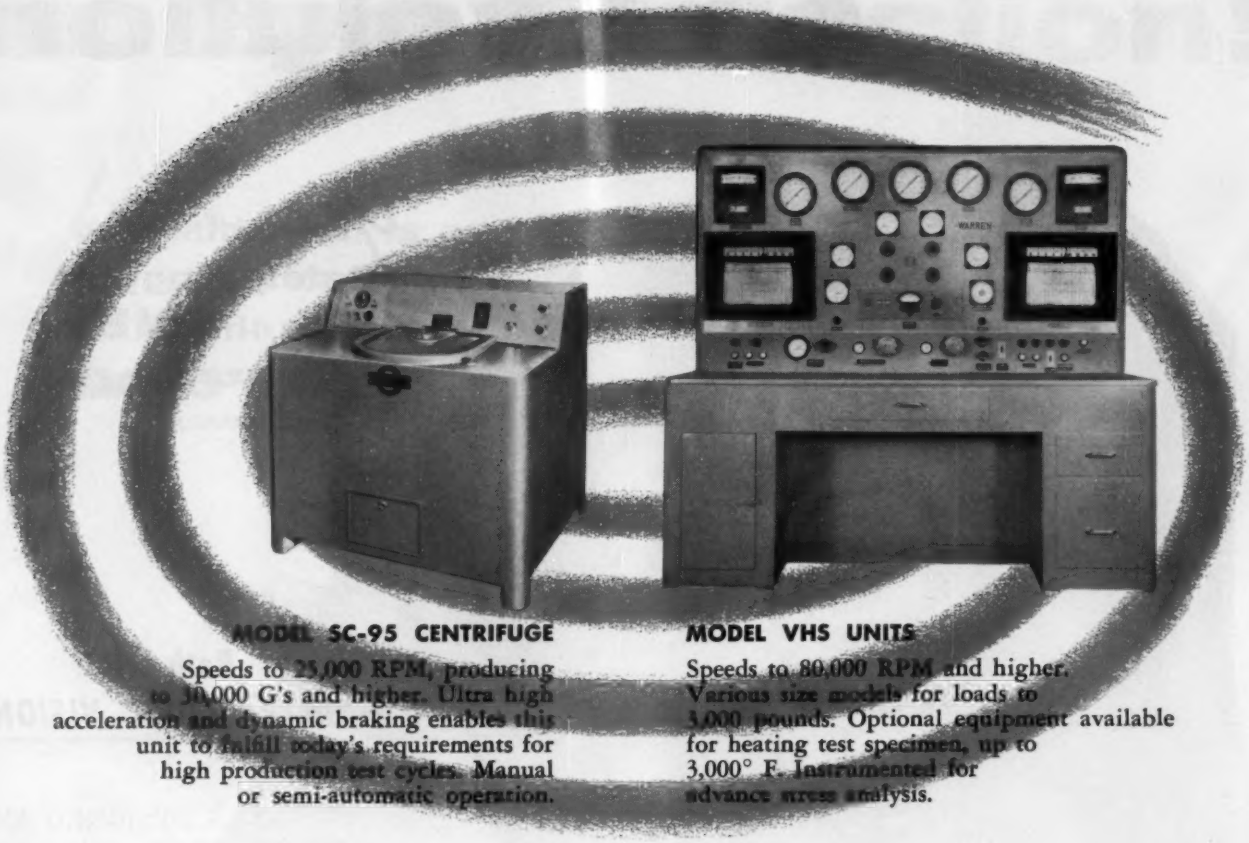

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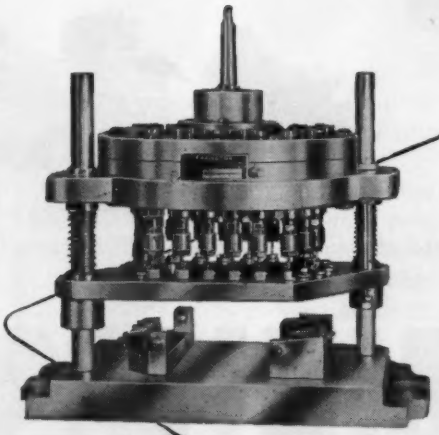

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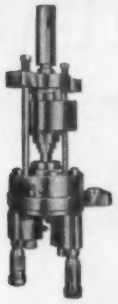

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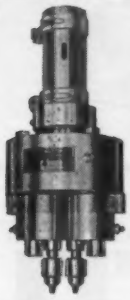

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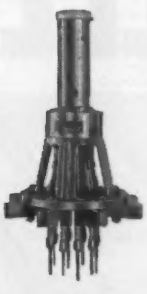

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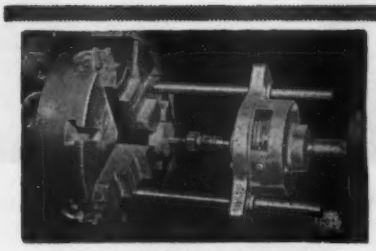

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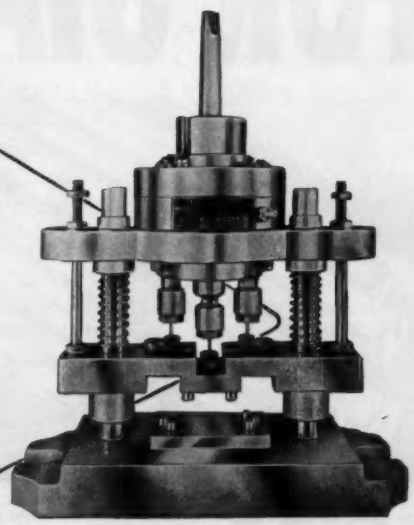

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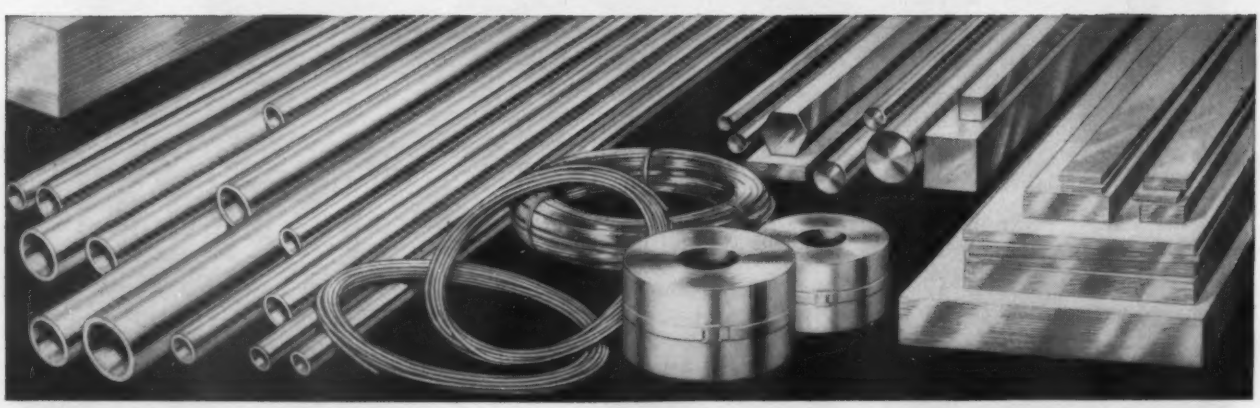

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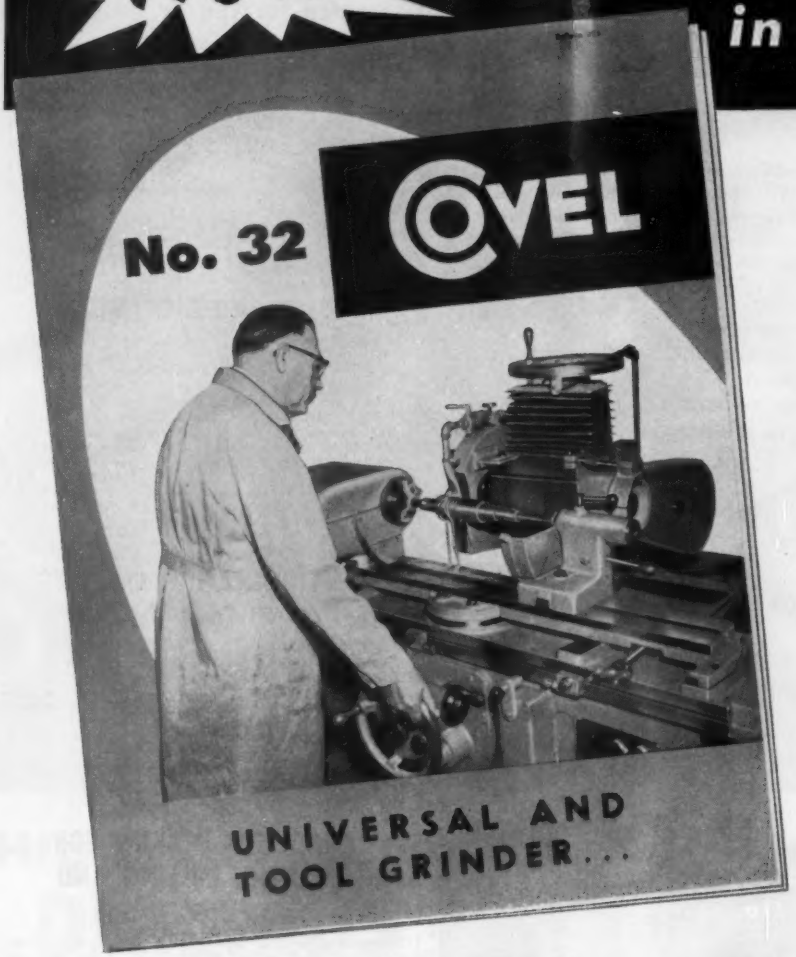

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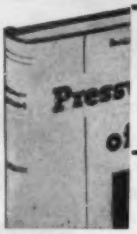

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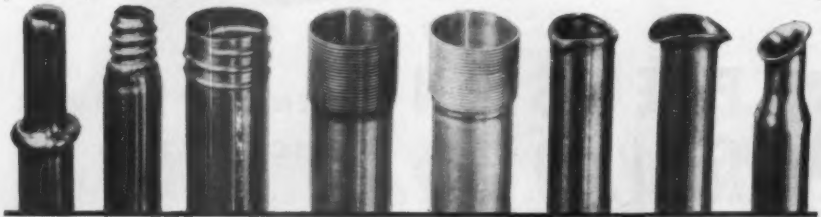

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Stuart's CODOL is a carefully designed liquid grinding compound that is *far more than just a coolant*. CODOL has been scientifically compounded to provide far more detergency than ordinary water-mix grinding fluids. Wheel loading is greatly reduced and allows more pieces to be ground per wheel dressing.

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To be sure that you consider *all* of the important points, such as ease of mixing, resistance to rancidity, gumming and foaming, when selecting a water-mix grinding fluid, ask "the Man in the Barrel," your Stuart Representative, to call and help you. And write today for your copy of the Stuart Water-Mix Cutting and Grinding Fluid book.

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2729 S. Troy St., Chicago 23, Ill.

More than a "Coolant" is Needed

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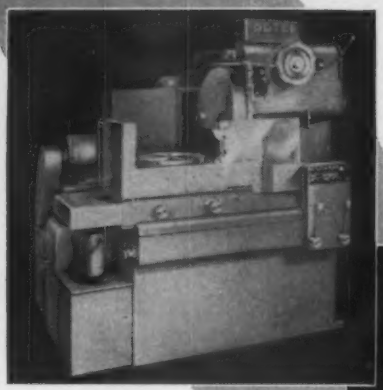
Time Tested Cutting Fluids and Lubricants

Plants in: Chicago, Detroit, Cleveland, Hartford, and Toronto, Ontario.

Branch Warehouses and Representatives in principal metal working centers in the United States, Canada and Europe.

ARTER FAMILY OF GRINDERS

A GENERATION of experience stands behind the ARTER family of grinding machines. Progressively these machines have attained advanced techniques, simplification of grinding processes, closer tolerances. Today ARTER is proud of the family especially the newest members, Models E and F Rotary Surface Grinders.

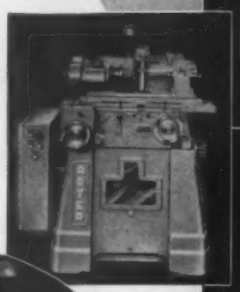


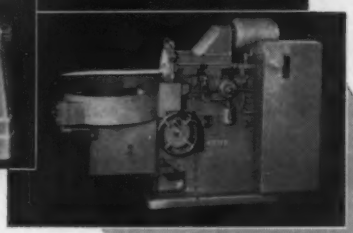
MODEL E—12" AND 16" ROTARY SURFACE GRINDER

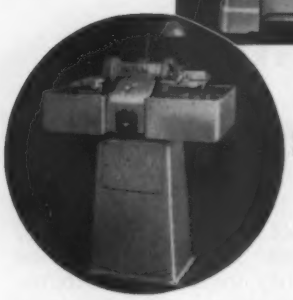
MODEL F 12" ROTARY SURFACE GRINDER

MODEL D—SPECIAL SEMI-AUTOMATIC ROTARY SURFACE GRINDER ARRANGED WITH WORK-LOADING AND PUSH BUTTON GRINDER CYCLE

MODEL 103—CYLINDRICAL AND INTERNAL GRINDER







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ARTER GRINDING MACHINE CO.

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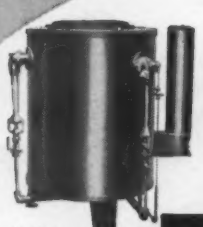
NO BLOWER OR OTHER POWER NEEDED

JUST CONNECT TO GAS SUPPLY



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O. W. Thuseman

PRESIDENT • CINCINNATI GEAR CO.

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After all, the men who work in our plant *are* craftsmen — skilled craftsmen of the highest order. We are managing the business — our skilled craftsmen are turning out the perfect gears that are the lifeblood of our business.

These men are important—we strive at all times to give them the finest machinery and the most pleasant working conditions possible. Craftsmen who have been with us five years or more are covered by a pension plan, with retirement benefits up to 30% of their regular monthly pay; our suburban location means a cleaner and more beautiful plant; color experts decided what color paints would be most conducive to a pleasant atmosphere inside our plant.

Our efforts have not been in vain — for over thirty years, when virtually every company had so-called "Labor" problems, production and pleasant relations at Cincinnati Gear continued as in the past.

No, we don't employ laborers at Cincinnati Gear — they are, and always will be, "Skilled Craftsmen!"

THE CINCINNATI GEAR CO.

CINCINNATI 27, OHIO

"Gears — Good Gears Only"

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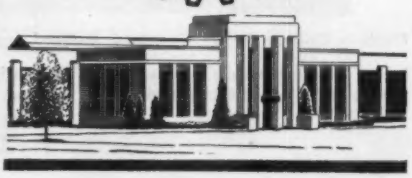

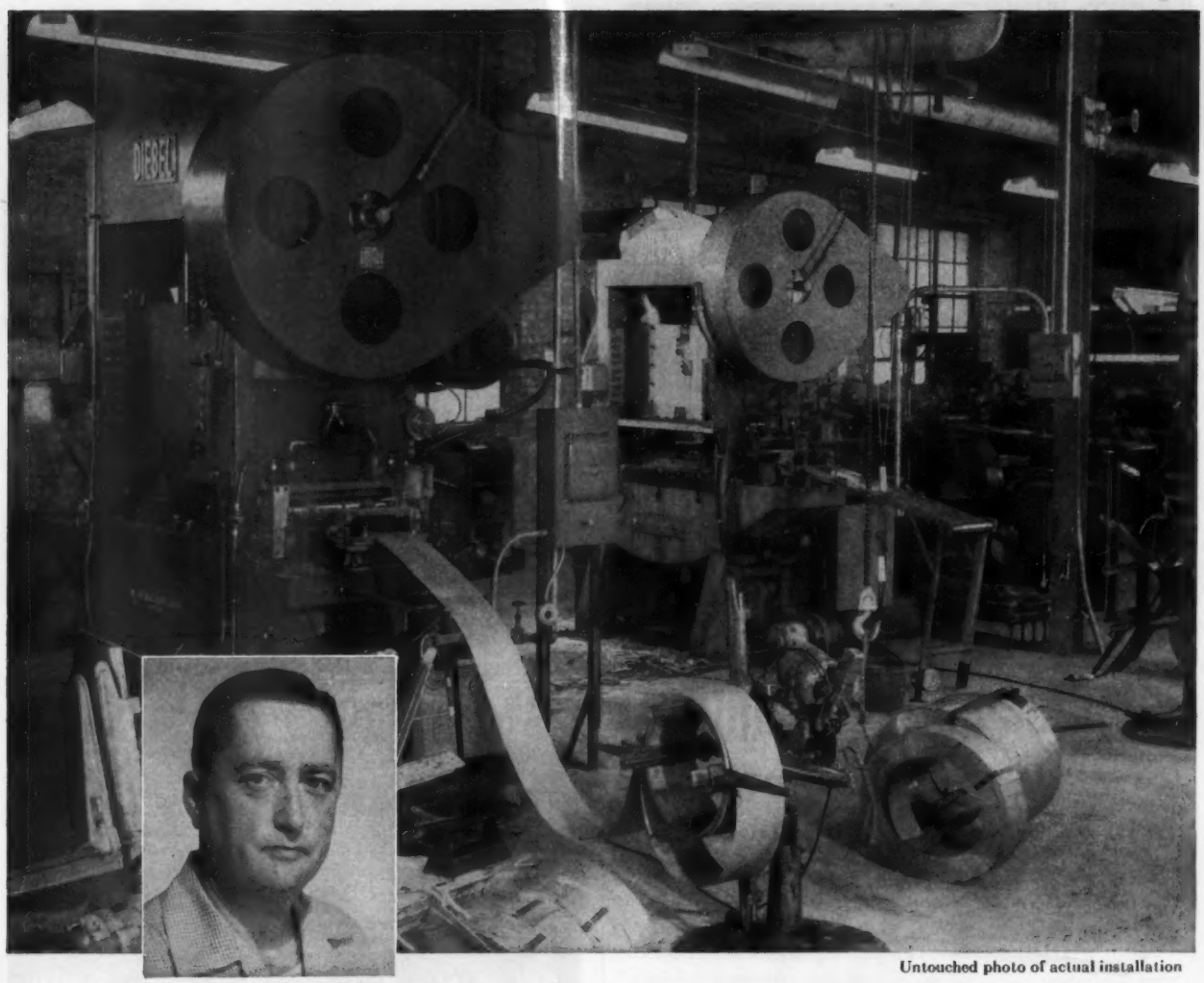

Untouched photo of actual installation

Sola Electric Gets Extra Day's Work Every Week with DIEBEL AUTOMATIC PRESS!

You need simply observe Sola Electric Company's progressive press room re-equipment program to see why they are a leading manufacturer of constant voltage transformers and fluorescent ballasts! Doing it faster, better, more economically . . . doing it automatically is the by-word at Sola!

As Max Haussler, in charge of tool making and metal working operations, explains it, "Our first installation of the program was a Diebel 60 Ton Automatic Press for stamping laminations. We soon discovered that the Diebel Press was giving us a 30% reduction in labor costs of producing laminations."

"In addition, we increased production between grinds by 30% and *die chipping was virtually eliminated!* Then too, down time and set-up time has been cut in half and maintenance costs are next to nothing! As our records show, we are getting an extra day's production every week over the former operation . . . thanks to the Diebel Press!"

In these times, can *YOU* afford anything short of a fully automatic press room? Diebel Presses are compact, self-contained, fully automatic *factories* in themselves, delivered completely equipped and ready to work for you . . . even the die if you choose!

Remember, the men at Diebel are automatic press specialists, ready and willing to help you with your stamping problems. A Press Plans Board and Engineering Staff are at your disposal. Next time, consult with Diebel first . . . and get *automatic* profits!

DIEBEL HI-PRODUCTION AUTOMATIC PRESSES

A COMPLETE LINE FROM 5 TO 100 TONS

BUILT BY DI MACHINE CORPORATION, 2718 WEST IRVING PARK, CHICAGO 18

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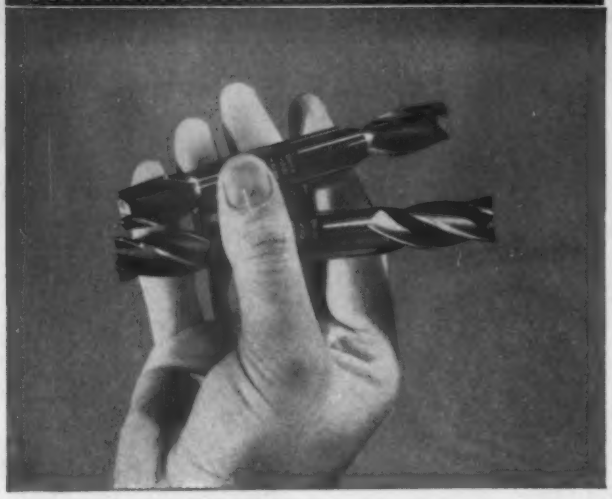

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Double-End End Mills

FOR DOUBLE DUTY

Weldon Double-End End Mills originally developed by Weldon give you double the service for much less than the cost of two single end mills of equal size. They save production time, too, because to change the mill you simply turn it end for end.

Weldon leadership in the cutting tool field has been achieved by many original features which contribute to faster, better performance and longer tool life.

Weldon distributors throughout U.S.A. and Canada carry complete stocks to serve you.

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use a GRIPCO LOCK NUT

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in these and hundreds of other applications where stress, wear or vibration is a factor. The Gripco Lock Nut, with its simple, one-piece design, has given industry a tighter, more positive holding action for quicker fastener application at less initial cost. No inserts, outside devices or complicated features – the Gripco Lock Nut holding or locking action is inherent in the nut itself – it costs less to use, gives an easier, faster locking and holds tighter for a longer time. Impervious to oil or water. For faster production, lower manufacturing and maintenance costs, look into the Gripco Lock Nut today.

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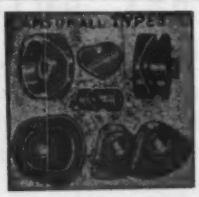

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are accurate, reliable and built to stand hard usage.

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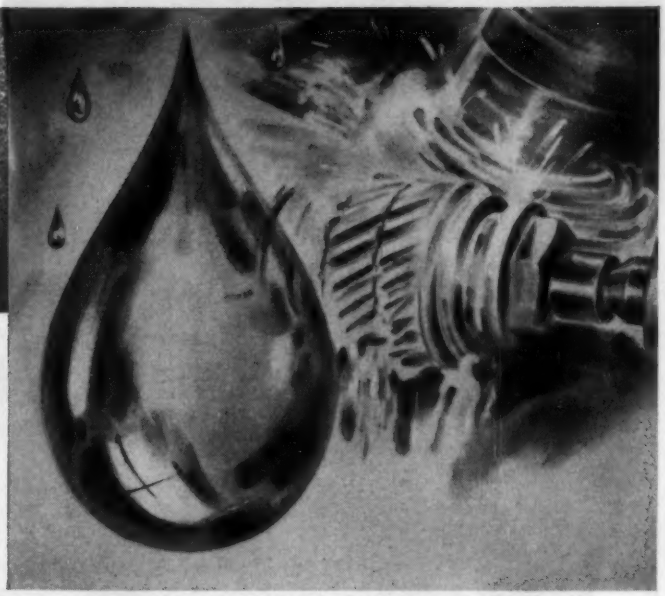
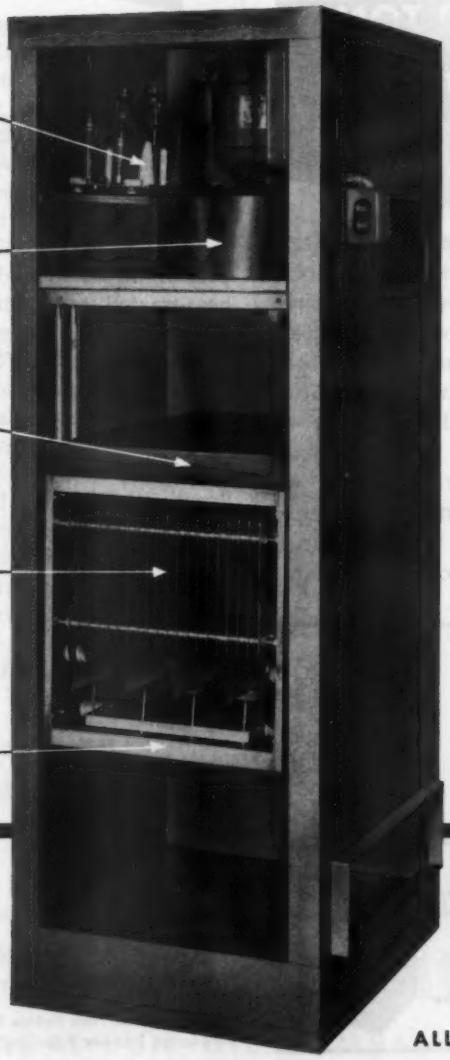
Electro-Staynew Mist Collector

eliminates oil mist and smoke at the source . . .





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CLEANS AIR ELECTRONICALLY

Electro-Staynew Mist Collectors are specifically designed to be mounted on or near high speed machine tools. These Dollinger-engineered, electrostatic filters draw contaminated air from around grinding or cutting operations, *remove* over 90% of the oil mist and smoke, and then return clean air to the shop. Look at these exclusive advantages:

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For complete information, write today for Bulletin 420.

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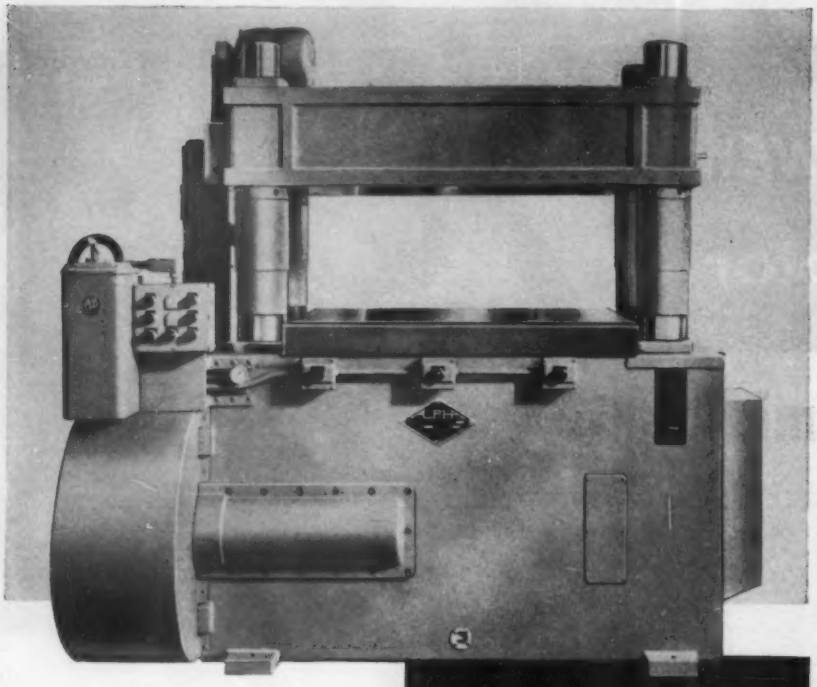
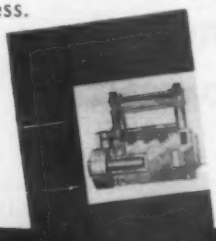
ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED



Send for your free folder which gives you full details concerning this amazing press.



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Manufacturers of die tryout and production presses since 1945

Alpha's NEW 100 TON Production Press

has all of these features

Forced feed lubrication • Herringbone Back Gear • Air Clutch • Can be equipped with variable drive (40 to 80 strokes per min.) • Two, hand operated safety push button controls and one emergency stop button • Occupies small floor space, 75″ x 84″ • Low height, 7′ • Complete clearance between posts from front to back and left to right • No pits to dig.

Save your large JIG BORERS for large jobs . . . put small precision work on the LINLEY . . .

The Linley Jig Borer provides the means . . . at very low cost . . . of handling your most exacting requirements in precision. With it you can cut costs through having a tool exactly fitted to your small work . . . save your larger machines for larger work.

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Industry prefers STAR quality, prefers the blades made of carefully heat-treated, top-quality steel, fabricated on specially designed equipment—because STAR consistently delivers fast, economical metal cutting and long blade life.

Be sure to ask your Industrial Distributor for STAR "Moly"® High Speed Steel Blades. STAR developed this high speed, heavily-alloyed steel blade of molybdenum. Remember, "Moly" High Speed blades outlast standard steel blades 10 to 1, cut as well as the *best* high speed steel blades made, but are substantially lower in cost.

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SOLNUS	**In tight systems** where make-up oil is less than 5% per month.	**Moderately priced**...excellent stability and rust protection.
SUNTAC	**In leaky systems** where make-up average is 5% or over per month.	**Reduced leakage** in systems cuts oil costs and downtime.
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SUNVIS H.D. 700	**In systems contaminated** by dust and deposits of sludge, varnish, etc.	**Cleansing action** removes deposits and eliminates costly teardowns.
LUBEWAY	**In dual purpose systems** of machine tools where hydraulic oil is also a way lubricant.	**Added film strength** of this hydraulic oil also eliminates "stick-slip" on ways.

CHART SHOWS WHERE AND WHY SUN HYDRAULIC OILS SAVE MONEY

As the chart shows, to operate your hydraulic system at maximum efficiency and minimum cost you must consider the condition of your hydraulic system, as well as pressures, operating temperatures and other usual factors.

And, very important, you must consider the age of your system. Continued use of original oil recommendations can be costly. A change in the type of oil can often result in substantial savings...especially where systems have developed leaks or where sludge and varnish cause excessive maintenance.

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HOT PRESSED AND SINTERED CARBIDES · VACUUM METALS
HEAVY METAL · CERMETS · HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

CUT OUT CHATTER

GRIND WITH

RED-E ANTI-FRICTION CENTERS

—and eliminate down-time changing wheels, diamonds and coolants—have micro finish, always!

Grind with RED-E and be sure!

1. ABEC-7 spec. bearings.
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7. Accuracy guaranteed to within less than .00005" T.I.R.

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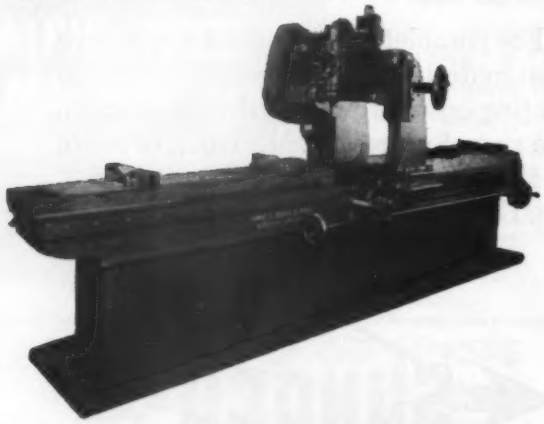
BURR KEYSEATERS
MILLING MACHINE, Planer Type



The Burr Keyseat Milling Machines while intended primarily for keyseating are suitable for a large variety of plain milling. They are made in six sizes from 36" to 144" table length. Also built to your specifications. This is a sturdy heavy duty machine equipped with a vertical head and Timken antifriction bearings throughout.

Also Burr Portable Shaft Keyseaters in five sizes for hand, drill and motor operation.

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JM3

STANDARD HORSE NAIL CORP.
Since 1872
NEW BRIGHTON, PA

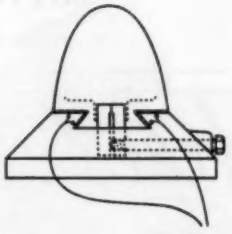
PRESENTING—

the NEW *Bridgeport* Ram and Turret

WORM GEAR ADJUSTMENTS for setting head at angles in two planes or combination of same.

STANDARD SWIVEL ADAPTER makes it possible to set Shaping or Cherrying Attachments at angles.

RACK AND PINION CONTROL for in or out movement of Ram.



NEW (pat. pending) EXPANDING DOVETAIL LOCK binds all four surfaces together giving vibration-less performance.

The New BRIDGEPORT Ram and Turret has been designed and tested for full utilization of the 1 HP back-geared BRIDGEPORT Milling Head.

This Ram permits full universal setting of the Milling Head, Shaping and Cherrying Attachments.

Our toolmakers prefer it after a six-month test.

We are sure you will like it.

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Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

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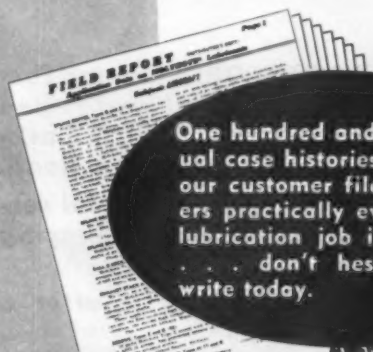

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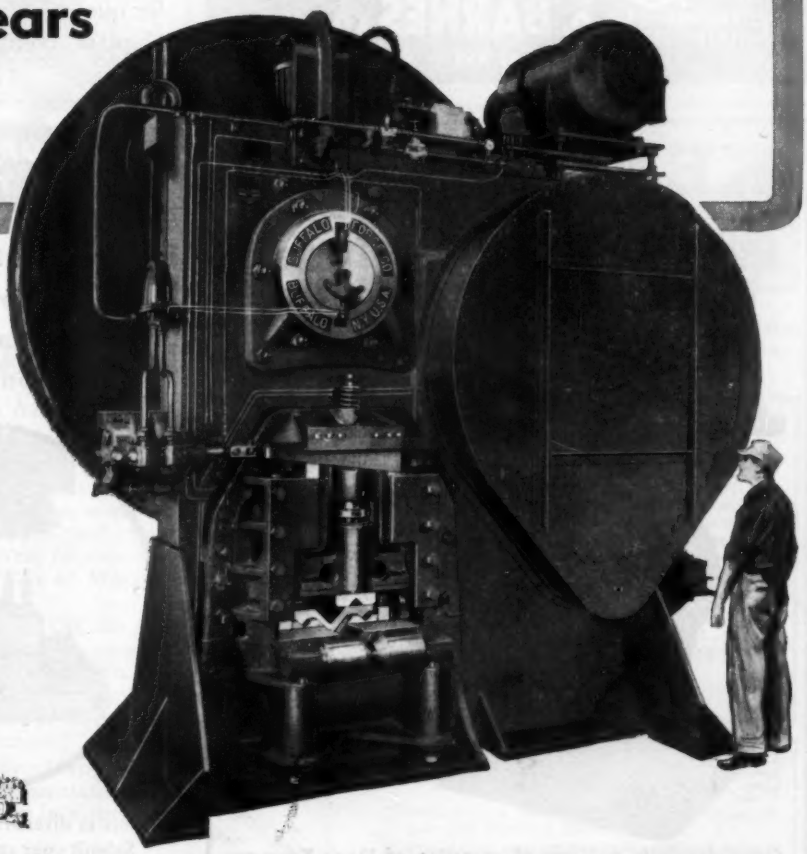
YOU CAN STEP UP OUTPUT and QUALITY with "BUFFALO" Billet Shears



First, the high cutting rates of "Buffalo" Billet Shears step up your production. The big No. 17 at right shears six 9" squares or 10" rounds per minute, and speeds are correspondingly higher in our smaller models. Second, your cuts are clean, square and uniform. The knife penetrates only 3/16", localizing an accurate vertical fracture. *Write today for Bulletin 3295-B and see the "Q" Factor* features that make "Buffalo" Billet Shears your most economical and accurate means of preparing stock for forging.*

**The "Q" Factor—the built-in Quality which provides trouble-free satisfaction and long life.*

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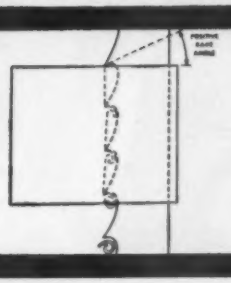
HOOK TOOTH

BAND SAW BLADES



NEW "HOOK TOOTH" DESIGN PERMITS MORE BITE WITH LOWER FEED PRESSURE —GREATER CHIP REMOVAL WITHOUT INCREASING FRICTIONAL HEAT.

In the new Barnes "Hook Tooth" blades, all Barnes' quality features have been retained—only the "hook" has been added to improve cutting. The new positive rake angle inclines teeth toward work resulting in more bite at lower feed pressure.

"Hook Tooth" blades cut faster and easier. They last longer. This means real savings for you!

Call Your Barnes Distributor

ORDER BARNES "HOOK TOOTH" BAND SAW BLADES

BARNES

ESTABLISHED 1919

W. O. BARNES CO., INC.

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KEYSEATING

The Modern Way

Illustration shows typical set-up for cutting taper keyways with table tilted.

Machines are made in three sizes for keyways 1/16" to 1" in width.

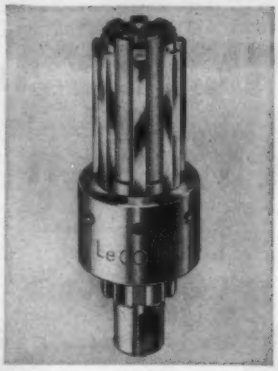
Great simplicity and ease of operation of Davis Keyseater, assure the user of accurate, time saving work.

Let our engineer study your keyseating problems.

DAVIS KEYSEATER COMPANY

403 EXCHANGE ST. ROCHESTER, N. Y.

Special Mandrels and Holding Fixtures solve production problems



This Le Count "Special" 7-jaw Mandrel locates in 7 cam grooves of a part requiring precision peripheral grinding. With a Le Count "Special" Holding Fixture for positioning, the operation is now on a production basis.

Le Count "Special" Mandrels are built for threaded, extra long, tapered, splined, polygonal and plural diameter bores. They have guaranteed accuracy of .0002" or .0005" T.I.R. and their unique hand-manipulation feature permits work on weak, thin-section and non-ferrous materials as well as on tough steel. Combined with Le Count "Special" Holding Fixtures, they have solved many locating problems where precision machining, assembly or inspection are performed from the bore.

Write for our literature or send specs and drawings for quotation. **Le Count Tool Works, Inc., 390-A Capitol Avenue, Hartford, Conn.**

IF YOUR ASSEMBLY REQUIRES MORE THAN ONE EYELET...

Eliminate those extra handling operations!

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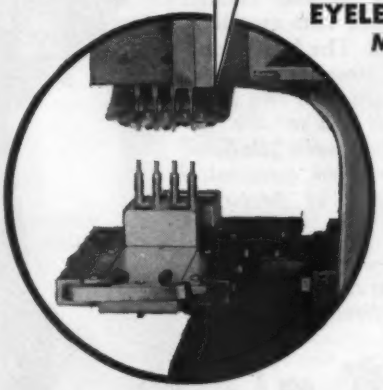
AUTOMATIC EYELET ATTACHING MACHINERY



You'll be surprised at how inexpensively you can obtain Edward Segal machinery for multiple eyelet setting, and how it slashes production time and costs... Used in hundreds of plants in diversified industry wherever eyeleting is called for.

Submit your specs for analysis today, and write us for our interesting booklet loaded with eyelet setting data, #40

EDWARD SEGAL • 72 SPRING STREET, NEW YORK 12, N. Y.

Eyeleting machinery, special hoppers & feeding devices

Massey-Harris-Ferguson eliminates reworking of finished pieces with Surfindicator. This production tool cuts their machining cost.

"SURFINDICATOR* *cuts our costs by eliminating extra machining"*

The Brush SURFINDICATOR enables the operator to measure, at the machine, the exact surface finish which he is producing. Thus, it allows him to take necessary steps to make this the optimum surface finish from a cost to performance standpoint. The surface finish of these farm implement parts is checked right on the production floor at Massey-Harris-Ferguson Inc., Racine, Wisconsin.

They state: "Using the SURFINDICATOR, we can immediately see if parts are within the range of design specifications for finish. Considerable machining time and cost has been saved by eliminating reworking of finished pieces to meet specifications. The Surfindicator is an asset to our work because of its portability and simple direct measurement."

You can cut *your* costs, simplify *your* inspection with the SURFINDICATOR. Let a Brush representative demonstrate this portable, easy-to-use instrument in your plant. Send coupon today.

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INDUSTRIAL AND RESEARCH INSTRUMENTS
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BRUSH ELECTRONICS

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SEE THE SURFINDICATOR AT THE NATIONAL METAL EXPOSITION IN PHILADELPHIA, BOOTH No. 1728.

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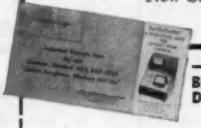
One uniform standard for surface finish now replaces many individual practices. You can now specify surface roughness and character of a surface in the same terms as other plants, your suppliers and your customers.

Send for new booklet containing important excerpts on the ASA STANDARD and including information of the SURFINDICATOR . . . the only instrument completely meeting the New Standard.



BRUSH ELECTRONICS COMPANY
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Cleveland 14, Ohio

☐ Please send booklet describing advantages of new ASA Standard B46.1.

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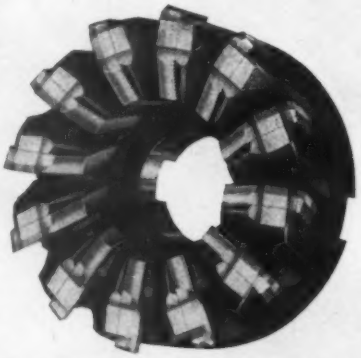
Here's a PRODUCTION Cutter

for your

HEAVY DUTY JOBS

APEX offers many cutters for many jobs. Here's one that takes a big chip fast. It can be had with H.S.S., Stellite, Cobalt or Carbide tipped blades. These blades adjust automatically in two directions. No damage to carbide tips. Diameters from 8" to 24". We also make cutters for *lighter* work. Write for catalog.



APEX TOOL & CUTTER CO., Inc., Shelton 10, Conn.

MODERN CUTTING - OFF MACHINE

Cuts off longer pieces than regular automatic machines—*any length you want.* FAST cutting and chamfering of tubing, pipe, shafting. Check the following figures:

½" Tubing	¼" Cold Rolled	1" Tubing
Cuts and Chamfers both outside edges of ½" .030 wall tubing, 5" lengths, every 2.5 seconds.	Cuts and Chamfers both ends, 20" long, at rate of 1 every 20 seconds.	Cuts and Chamfers both outside edges, pieces 3" long. One every 3 seconds.

These popular, time saving machines are now available in four sizes, handling work up to 6¾" O.D. Their many cost cutting features are described and illustrated in our latest catalog that will be mailed promptly on request.

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MODERN MACHINE TOOL CO.

2005 LOSEY ST. JACKSON, MICHIGAN

HYDRAULIC PRESSES

MODEL 23B — 150 TON
Down-acting, metal working

MODEL 1000H— 1,000 TON
Hobbing press, shown with safety guard

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KING PORTABLE

accuracy guaranteed to well within ASTM requirements

THE VERSATILE KING PORTABLE:

- puts a load of 3000 kg on a 10mm ball—other loads as required.
- can be used in any position—even upside down.
- has a removable test head for testing large size parts.
- can get into small, cramped spaces, tubes or cylinders.

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Are selected for dependability, longer life and greater capacity. Standard sizes are carried in stock. *Write for our general catalog No. 19.*

THE BALL AND ROLLER BEARING CO.
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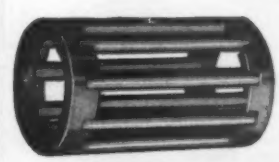
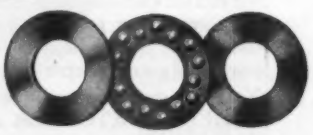
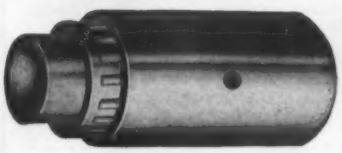
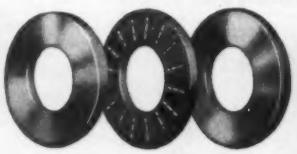
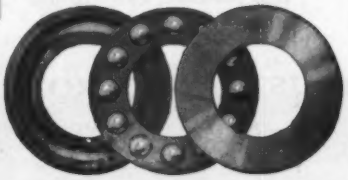
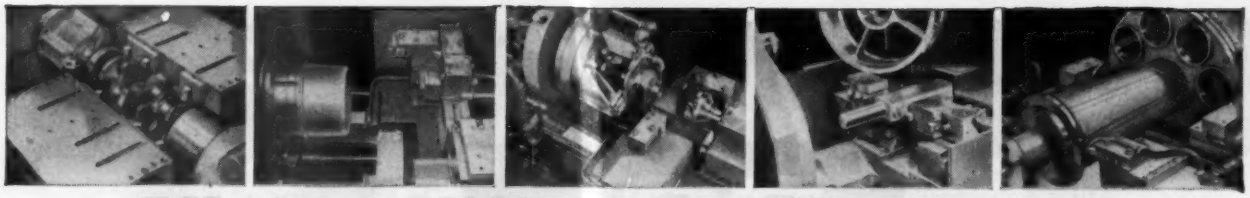




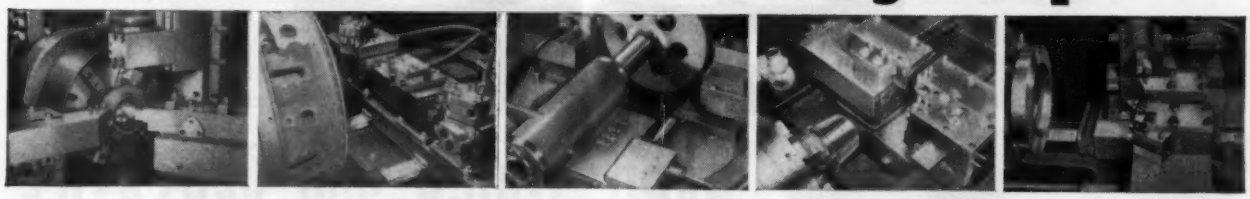




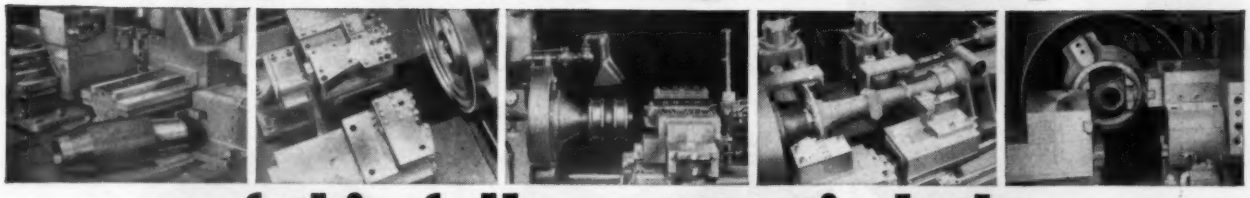




All these different tooling setups



show the amazing versatility



# of this fully automatic lathe

...the SIMPLIMATIC

Here's versatility that beats any automatic lathe you ever saw! Actually, the Simplimatic is doing hundreds of jobs like these—jobs that would otherwise be put on *special* machines—built at extra-special cost. But this (and don't miss the important point!) is a *standard machine*—at a *standard price.*

If you have medium or long runs on parts up to 33½" in diameter, get the facts about the Simplimatic Automatic Lathe.

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MACHINE COMPANY
Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES
SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

THE GISHOLT ROUND TABLE

represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

THIS CATALOG may show you how the Simplimatic can save thousands of dollars for you as it is doing for many others. Write for your copy.

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Madison 10, Wisconsin
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Please send my copy of the Simplimatic Catalog.

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Company.....
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Hollow Mill Maker finds

DBL-2
High Speed Steel

HARD, TOUGH and VERSATILE

The maker of these adjustable hollow mills required a steel that would give top performance in a variety of jobs—turning, tapering, facing, chamfering and trepanning. After thorough testing, Ludlum's high speed DBL-2 was selected.

DBL-2 is an improved general-purpose high speed steel. It contains tungsten, molybdenum and vanadium in such proportions that it excels 18-4-1 for most applications. DBL-2's unusual combination of high hardness with toughness, its ability to hold a fine grain over a wide hardening range, and the fact that it easily machines many diverse types of stock, made it particularly well suited for this job.

In addition to these advantages, DBL-2 can be heat treated in the same furnaces and atmospheres as 18-4-1 without fear of harmful decarburization. These DBL-2 blades were heated to 2250 F, oil quenched and drawn twice at 1025 F. After heat treatment, blades easily machined such stock as aluminum, stainless steel, carbon steel, aircraft steel, plastics, bronze, screw stock, cast iron and brass.

There is an A-L tool steel to meet your toughest requirements. Call your A-L representative or distributor today . . . or write *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania.*

Write For Copy of
"CUTTING TOOL MATERIALS"
This 36-page illustrated booklet analyzes and compares types and covers grade selection for all major classes of cutting tools, etc., invaluable data for production men. Write for your copy today.

Address Dept. AM-70

For complete **MODERN** Tooling, call

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AL® FINE TOOL STEELS SINCE 1854

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Machine Shop Assistant needed by medium sized heavy process machinery manufacturer. Young college engineer graduate with some experience preferred. Position has a future. First duties will cover rate setting, carbide tool development and assist in increasing productivity. Company has liberal profit sharing plant. Salary open. Location S.E. Penna. Reply P-7616, American Machinist.

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Salaried Positions, $5,000 to $35,000. We offer the original personal employment service (established 45 years.) Procedure of highest ethical standard is individualized to your personal requirements. Identity covered; present position protected. Ask for particulars. R. W. Bixby, Inc., 652 Brisbane Bldg., Buffalo 3, N. Y.

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Wanted—Manufacturer of small tools and light machinery wants new items to increase sales volume. Have 3000 active distributors on present line. Established over 30 years. Reply RA-7465, American Machinist.

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graduated	30	years
Design engineer	3½	"
Works engineer	2	"
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wants to change his situation.
Write to J. P. VOISARD, av.
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MACHINE TOOL RECONDITIONING & the Art of Hand Scraping
Write for folder describing illustrated book
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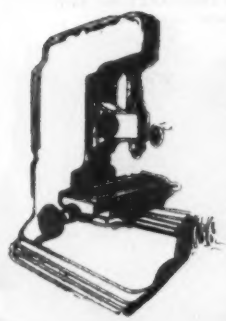

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Your requirements will be brought promptly to the attention of the used equipment dealers advertising in this issue. You will receive replies directly from them. NO CHARGE • NO OBLIGATION

Please help us locate the folowing used equipment:

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NAME ..... TITLE ..... COMPANY .....

STREET ..... CITY ..... ZONE ..... STATE .....

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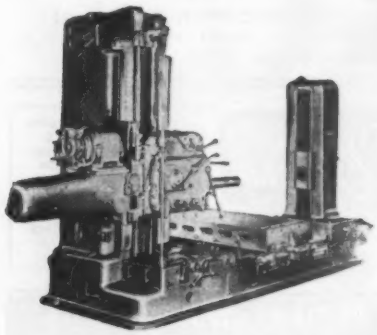
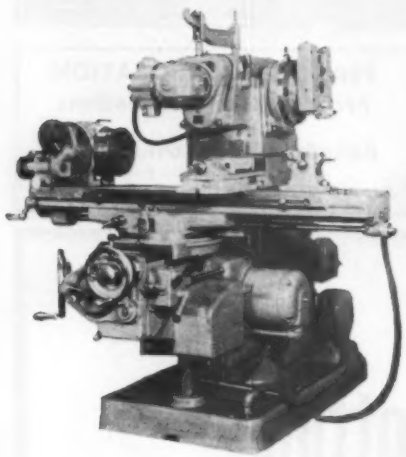
MOREY MACHINE TOOLS

For Half A Century

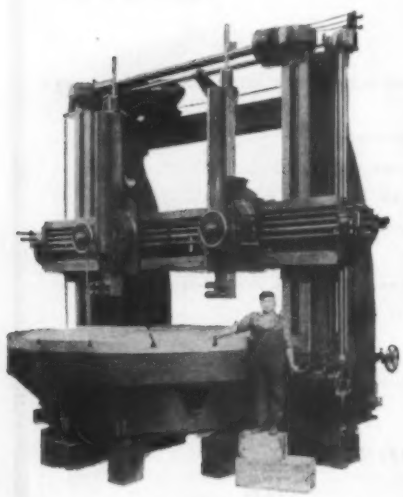
New • Used • Rebuilt



SELLERS 5" bar, table type, Precision High Speed Horizontal Boring Mill.



BROWN & SHARPE No. 2 Light Type Plain Miller



SELLERS 144", 2-swivel heads on cross rail; PRT, motor drive.

BORING MILLS—Horizontal
JIG BORERS

DEFIANCE Model 25-A Boring Mill 3¼" bar; late
EX-CELL-O #112-C Single End Double Spindle
EX-CELL-O No. 2112 single end, double spindle
GIDDINGS & LEWIS 340-T; 4" bar; late type
HEALD No. 47-A single end Bore-matic; late
HEALD #49 single end Borematic; M.D.
HEALD No. 49 double end Bore-Matic; latest
LANDIS No. 35, 3½" Floor Type, motor drive
NILES 8" bar; floor type; motor drive
SELLERS 5" bar Table Type; late type
SELLERS 5" bar Floor Type; late type

BORING MILLS—Vertical

BULLARD 8", 8-spindle Type "D" Mult-au-matic
BULLARD 16", 6-spindle Type "D" Mult-au-matic
BULLARD 24", vertical turret spiral drive; late
BULLARD 36" high speed 18" extra high column
BULLARD 36", vertical turret spiral drive, late
CINCINNATI 54" "Hypro"; PRT; late type
NILES 53, 2-swivel heads; PRT; M.D.
NILES 36-44" Vertical Turret Lathe; late type
NILES 100" Heavy Duty Vertical; PRT, late
SELLERS 144", 2-swivel heads on cross rail; power rapid traverse, motor drive

BROACHES

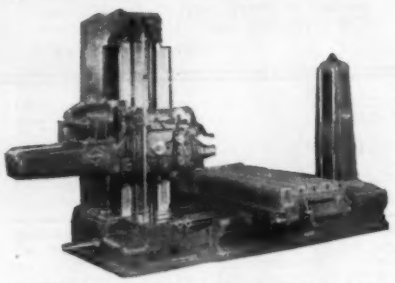
CINCINNATI 1-36 Duplex Vertical, cap. 2,000 lbs. 30" stroke, Hydraulic; late
COLONIAL VGI-10-48 Vertical, cap. 20,000 lbs.; 48" stroke, Hydraulic; late
LaPOINTE 10-54" Vertical, Model SRV, cap. 20 000 lbs.; 54" stroke; new 1947
LaPOINTE model SRV 10-ton, 48" stroke; latest
OILGEAR 3XA Horizontal, cap. 20,000 lbs.; 56" stroke, Hydraulic; late
OILGEAR XL-6 Horizontal; cap. 3-tons; 36" stroke; latest type

DRILLS—Radial

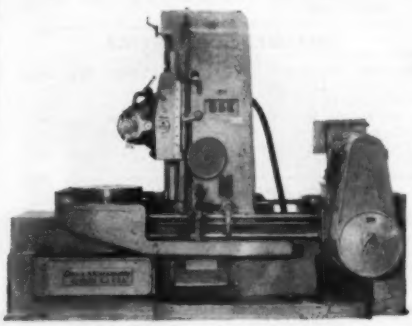
AMERICAN 5' arm 13" col. "Hole Wizard"; late
AMERICAN 5' arm 11" col. "Hole Wizard"; universal table; late type
AMERICAN 7' arm triple purpose; M.D.
CARLTON 6' arm 19" column; late type
CINCINNATI BICKFORD 6' arm 15' col., Univ.
CINCINNATI BICKFORD 3' arm 11" col,, latest
MORRIS 3' arm 9" col., late type
MORRIS 4' arm 11" column; late type

GRINDERS—Cylindrical, Plain and Universal

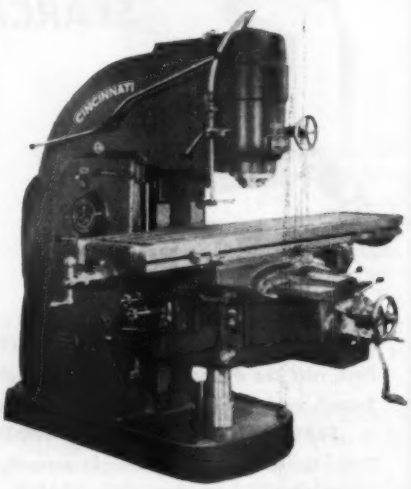
BROWN & SHARPE No. 1 Universal; 10"x20"
BROWN & SHARPE No. 2; Univ.; late type
BROWN & SHARPE No. 4 Universal 14"x60"
CINCINNATI 6"x18" Plain, "Filmatic"; Model ER
CINCINNATI 14"x72"; Universal; Model ER
HARTEX 16"x60" Univ. model RHU-1520; New 1953
LANDIS 4"x12" Type "H" Hyd., Plain; late
LANDIS 10"x18" type "C" Plain; hydraulic
LANDIS 10"x36" Plain; motor drive
LANDIS 10"x36" type DC plain hyd., with infeed; M.D., late type
LANDIS 16"x36" Type "C" Universal; late
LANDIS 20"x144" Plain Cylindrical Gap; M.D.
LANDIS "D" 25"x72" Crank Pin Grinder; late
LANDIS "C" 18"x72" Plain; late type
LANDIS type "C" 14"x72" Univ.; late type
LANDIS type "DCP" 10"x72" hydr., late type
NORTON 4"x12" model CTU Plain; new 1953
NORTON 6"x18" Type "C" Plain Cyl.; late
NORTON 10"x36" Plain; motor drive
NORTON 10"x48" Type "C" Hydr., Plain, Cyl. late
NORTON 16/20"x48" Plain, Cylindrical; late
NORTON 6/10"x18" Plain, Cylindrical; late
NORTON 16/26"x72" Plain, Cylindrical; late



SELLERS 5" bar, table type, Horizontal Boring, Milling and Drilling Machine; late type.



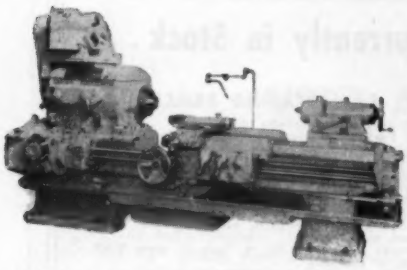
GOULD & EBERHARDT No. 36-H Universal Gear Hobber.



CINCINNATI No. 3 Dial Type; High Speed Miller.

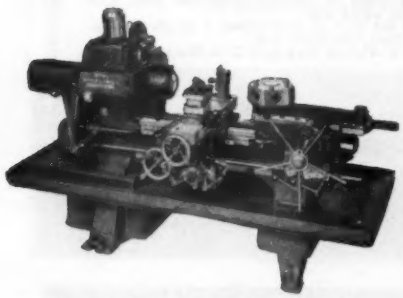
LATHES—Engine and Mfg.

BRIDGEFORD 48"x10' Geared Head Lathe
GISHOLT No. 12 Hydraulic Automatic Chucker; late
HENDEY 16/24"x30" centers; Timken; late
HENDEY 24"x36" centers, M.D.; late type
JONES & LAMSON "FAY" 8" Automatic; Timken
JONES & LAMSON "Fay" 20"x25" Auto., M.D.
LeBLOND 13"x30" "Regal" Mfg. Lathe
LeBLOND 16"x30" centers Auto.; Timken; late
LeBLOND Model 7ACL Crankshaft; 9"x30"; M.D.
LeBLOND 20"x48" centers; H.D. Timken; late
LeBLOND 27"x54" Mfg.; latest



LODGE & SHIPLEY 18"x36" centers model X Engine Lathe; Timken; late type

LeBLOND 27"x144" centers; motor drive
LODGE & SHIPLEY No. 3-A Duomatic; late
LODGE & SHIPLEY 12"x30" G.H. Toolroom
LODGE & SHIPLEY 14"x30" Centers; late type
LODGE & SHIPLEY 16/20"x54" Toolroom; Tim.
LODGE & SHIPLEY 18/22"x54" Toolroom; Tim.
LODGE & SHIPLEY 18"x30"; Timken; latest
LODGE & SHIPLEY 18"x54"; Timken; latest
LODGE & SHIPLEY 20"x48"; Timken; late type
LODGE & SHIPLEY 20"x54" Gap; Timken; late
LODGE & SHIPLEY 20"x144"; Timken; late
LODGE & SHIPLEY 22"x48" Engine; Timken
LODGE & SHIPLEY 22"x72" Engine; Timken
LODGE & SHIPLEY 22"x96"; Timken; late type
LODGE & SHIPLEY 24"x48"; Timken; latest
LODGE & SHIPLEY 24"x96"; Timken; late type
MONARCH 18"x48" Model CBB; late type
MONARCH 14"x42" centers; "Z" Magnamatic, Automatic; Timken, M.D., late



WARNER & SWASEY No. 5 Universal Ram Type Turret Lathe; Preselector head; late type.

NATIONAL No. 5 "Maxi-Press", 1000 ton capacity High Speed Forging Machine.

MONARCH 14"x54" centers; model AA; late
MONARCH 20"x144" centers; Model CM; (raises to Swing 31"); New 1947; late type
MONARCH 22"x264" c.c. Model M; late type
MONARCH 22"x336" c.c. Model M; late type
MONARCH 12"x30" model "KK" Engine; Timken
MONARCH 24"x60" model "M", Timken; late
MONARCH 24/36"x48" model "N", air tracer; 60 series; late type
MONARCH 16"x30" model "C", Timken; late
MONARCH 18"x48" "CBB" (raises to 26½"); Timken; late type

MONARCH 18"x72" "B" (raises to 26"); Timken
NILES 30"x25' bed, Single End Boring, "Time Saver"; late type
NILES 30"x46' bed, Single End Boring, "Time Saver"; late type
NILES 30"x108" centers "Time Saver"; Timken
NILES 36"x100" c.c. "Time Saver"; late type
NILES 42"x216" centers Geared Head; late
PORTER-McLEOD 16"x6' Lathe; New
PRATT & WHITNEY 16"x30" c.c.; Timken; late
SPRINGFIELD 14"x43" geared; M.D., late type
SPRINGFIELD 20"x48" centers, Timken; late
SUNDSTRAND 8"x15" Auto mfg., late type
SUNDSTRAND 10"x60" centers, Automatic; late
SUNDSTRAND 12"x22" Automatic; late type

LATHES, Turret

GISHOLT 1L Univ. Saddle type; Timken; late
GISHOLT 2L Univ. Saddle type; Timken; late
GISHOLT No. 3 Univ. Ram Type; Timken; late
LIBBY 1H6, 6" hole, long bed; late
LIBBY 4H-12" hole, M.D. Turret Lathe; M.D.
MOREY No. 2 ram type, Timken; latest type
MOREY No. 4 ram type; Full Univ.; latest
POTTER & JOHNSTON No. 4D Auto. H.S., Timken
POTTER & JOHNSTON No. 4D-5 model "FC"; late
POTTER & JOHNSTON No. 4D-6 high speed; late
POTTER & JOHNSTON No. 8DT Automatic Chucking & turning; late type
WARNER & SWASEY #1 "Electric", M.D., late
WARNER & SWASEY No. 1A Univ., PRT, late
WARNER & SWASEY No. 2 Ram type; Timken
WARNER & SWASEY #3 Univ. Ram Type
WARNER & SWASEY No. 4-A; Univ. 9" hole
WARNER & SWASEY No. 4, Univ., late type
WARNER & SWASEY No. 5 Univ., preselector head

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MILLING MACHINES—Vertical

BROWN & SHARPE No. 3; Timken; late
CINCINNATI 0-8 Vertical, Timken; late type
CINCINNATI #3 dial type; Timken; late type
CINCINNATI No. 4 Model ER Dial Type, Timken
CINCINNATI 28-60 Hydro-Tel; 3 spindle; tracer control; late type
CINCINNATI No. 3 dial type, medium speed; Timken; latest
CINCINNATI No. 3 dial type, high speed; timken; latest type
CINCINNATI 5-60 hydr., tracer control; late
KEARNEY & TRECKER "Milwaukee" model 2KM; Timken; latest type
KEARNEY & TRECKER "Milwaukee" model 2H; Timken; late type
KEARNEY & TRECKER "Milwaukee" No. 3H
KEARNEY & TRECKER "Milwaukee" model 4H; Timken; late type
REED PRENTICE No. 5, PRT; Timken; late type
SUNDSTRAND No. 1-S "Rigidmil"; late type

MILLERS, Profile and DUPLICATING MACHINES

CINCINNATI 28-60 Hydro-Tel; 3 spindle; tracer control; Timken; late
CINCINNATI 5-60 hydr., tracer control; late
PRATT & WHITNEY 30", 2-spindle; late type
PRATT & WHITNEY "Keller" model GG 1210; latest
PRATT & WHITNEY "Keller" model BL 2416; single spindle; 2 dimensional; late
PRATT & WHITNEY No. 30M Miller & Profiler Single Spindle; late type

PLANERS

GRAY 48"x48"x10' "Maximum Service"; 4 heads; Power Rapid Traverse; D.C. Reversing; M.D.
LIBERTY 144"x78"x49' adj. openside; box table; 4 hds.; vari-voltage; Power Rapid Traverse; M.D., late type; NEW 1940
NILES 48"x48"x10' double, 4 heads, PRT; M.D.
NILES BEMENT POND 72"x72"x30'; 4 heads; Power Rapid Traverse; D.C.; M.D.
POND 60"x60"x14' double housing; late type
SOUTHWARK No. 1, 16' Plate Edge Planer; late

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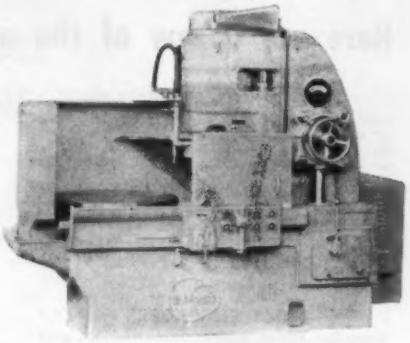
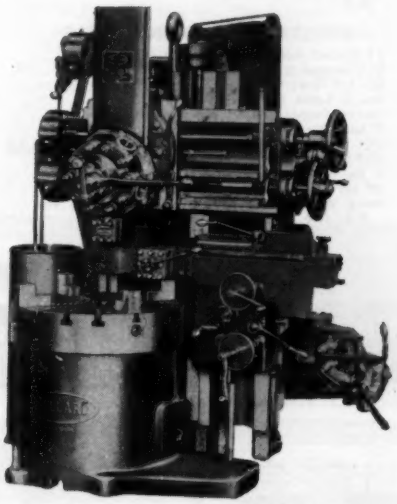
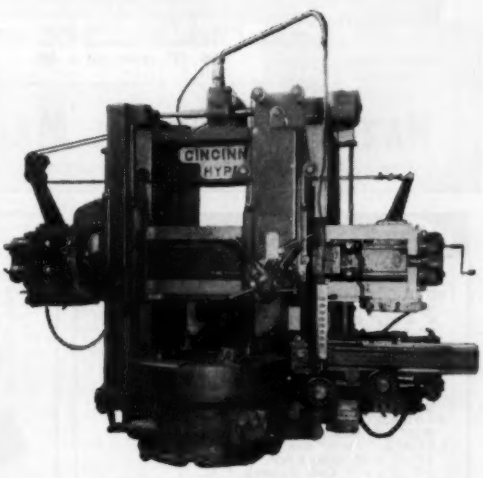


BLANCHARD No. 18 Surface Grinder, Rotary type, vertical spindle.



BULLARD 36" Vertical Turret Lathe.



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14" Fay Flanders Type, m.d.
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Model B—1-1/16" Cleveland, m.d.
Model A—1⅜" Cleveland Single Spindle, late
4 spindle 1⅜" Cleveland Model M, m.d.
No. 5 DELX Potter & Johnston, m.d., late
No. 6 DRELX Potter & Johnston, m.d., later type
2½" Cleveland, m.d., Model A
2" Cleveland Model A, single spindle, m.d.

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3" Universal Horizontal Boring Mill, m.d.
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No. 32 Lucas, m.d.
Barrett Double End, 7" and 5" spindles, m.d.
5" bar Ohio Table Type, m.d.
5½" bar Betts Floor Type, m.d.
5½" bar Niles-Bement-Pond, m.d.
6" bar Newton No. 2 Cylinder Borer, m.d.
10" bar Sellers Floor Type, m.d.
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Floor Plates—all sizes

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24" Bullard Spiral Drive, 1943
42" Bullard Spiral Drive, m.d., 1942
42" Bullard New Era, m.d.
42" King with side head and plain swivel head on rail, 1940
44" Putnam, m.d., p.r.t.
44" Niles, m.d., p.r.t.
48" Niles-Bement-Pond Car Wheel Borer, md.
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Baush Radial Drilling & Tapping Machine, m.d.

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No. 15 Buffalo Floor Model, m.d.
No. 18 Canedy Otto Bench Model, m.d.
No. ½, 1, 2 Avey, belted m.d.
No. 1B Edlund, m.d., new
No. 2 Avey Single Spindle, m.d.
2 spindle Allen, belted m.d., 8" overhang
No. 2LMS Leland-Gifford, single spindle, High speed, m.d.
2 spindle Avey, size No. 1, type B, style VHP, m.d., 8" overhang
2 spindle No. 3MAS Avey High Speed, m.d.
3 spindle No. 2MAS Avey High Speed, m.d.
2 spindle No. 2 Leland & Gifford High Speed, 8" overhang, m.d.
3 spindle Leland & Gifford #1LMS—High Speed, late, m.d.
3 spindle Leland & Gifford High Speed, Model 3MS, m.d.
4 spindle Leland & Gifford, m.d. on each spindle
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4'13" Col. Bick., New 1944
LATHES, 25"x192" Cen. L. & S., T.A., Late
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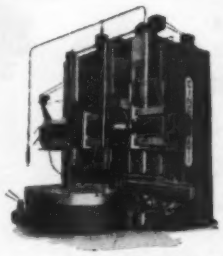

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10 ton 36" Stroke American 10-T-36 Broach, 1949.
12" x 72" Colonial Broach grinder, late.
5" x 36" Colonial Broach grinder, late.
24 Spindle No. B2B Natco multiple drill, 1942.
24 Spindle No. 3BL Natco multiple drill, late.
25" Cleerman round col. upright drill, late type.
9' arm 16" Col. American motor-on-arm radial drill.
No. 2 Cincinnati centerless grinder, Filmatic bearings, ser. 2M2H2F21.
4" x 18" Cincinnati pl. hyd. cylindrical grinder, 1946.
6" x 18" Landis "C", 30° head cylindrical grinder, 1941.
6" x 30" Cincinnati "EA" Filmatic plunge cut cyl. grinder "2" 1942-43.
No. 72A Heald hyd. sizematic internal grinder, 1945.
13" x 60" Model 300 Hanchett vert. spdl. surface grinder, late.
43" No. 16A2 Blanchard 2-spdl. rotary surface grinder, 1947.
9" x 18" Hendey tool & gage-maker's lathe, 1940.
14" x 46" Hendey toolroom lathe, 1940.
26" x 10' bed LeBlond Heavy Duty G. H. engine lathe.
15" x 30" Lipe Carbomatic hydraulic lathe, new 1942.
17" x 5' bed LeBlond Rapid Production lathe, 1946.
No. 5 Jones & Lamson universal turret lathe, preselector, 1939.
No. 2-20 Kent Owens hydraulic mfg. mill, (2) 1942.
Model M24 Kearney & Trecker Mfg. mill, 1943.
Nos. 2B-3B-3H-3K & 4K Kearney & Trecker mills
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113 Ton No. 78 Toledo gap frame press.
126 Ton No. 306 Bliss straight side press.
260 Ton No. 795½—72 Toledo D.C. toggle press.
350 Ton No. 409C Bliss D.C. Toggle press.
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545 Ton No. H3612½ Hamilton straight side press.

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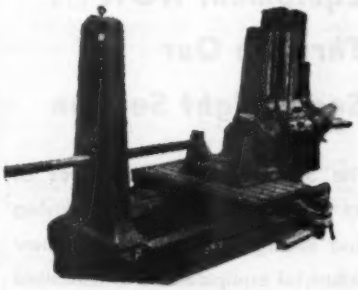

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100" Niles Vertical Boring Mill
Foote-Burt Vert., 5" dia. spdl., 26" sw. (1941)

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No. 49 Heald Borematics (1942)
No. 7-8" Bar Barrett Horr.

DRILLS

1 spdl-14" sw. No. 2 Avey Cam Feed (1942)
1 spdl-24" sw. No. 2MA-6 Avey, pow. fd.
1 spdl-26" sw. No. 4 MS Leland-Gifford (hyd.)
2 spdl-24" sw. No. 3 Avey
3 spdl-24" sw. No. 2MS Allen, Tap & B.G. (1942)
4 spdl-14" sw. No. 2LMS L-G
4 spdl-26" sw. No. 2LMS L-G back gears
6 spdl-26" sw. No. 2LMS L-G Tap & B.G.
6 spdl-30" sw. No. 3B Edlund (1942)
16 spdl-K60H Fox Multiple, (1944)

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11" Gleason Gear Generator
No. 36BM Gould & Eberhardt
No. 615A Fellows Gear Shaper
No. 612A Fellows Gear Shaper
No. 65 Fellows, Cone Drive
No. 12HS Gould & Eberhardt

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No. 4H, 4"x12" Landis Pl. Cyl.
3"x30" Norton Cam-O-Matic (1946)
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10"x18" Norton Type C (1941)
10"x36" Norton Type C Plain
10"x36" Norton Type C Cam Grinder
10"x48" Norton Type C Plain (1943)
14"x48" Landis Type C Plain
14"x48" Landis Universal
18"x36" Cincinnati Model ER Univ. (1942)
16"-26"x72" Norton Plain
18"x120" Norton Type A Plain
20"x96" Norton Plain
20"x32"x144" Norton Gap
20"x192" Norton Type A Plain
24"x264" Norton Type A Plain
Hill-Clarke Cylindrical Norton Type M.D.

10"x36" centers	14"x50" centers
10"x72" centers	14"x72" centers
10"x96" centers	18"x96" centers
14"x36" centers	22"x96" centers

No. TG615 J. & L. Thread Grinder
No. 81 Heald Internal Centerless
No. 74 Heald Internal Centerless
No. 72A3 Heald Univ. Internal
No. 72A5 Heald Internal (1942)
No. 72A5 Heald Bridge Type Int.
No. 5 Bryant Internal
No. 5A Bryant Hole & Face
No. 5B Bryant Internal
No. 16-16 Bryant Internal
No. 16A16 Bryant
No. 16-28 Bryant Internal
No. 16A28 Bryant Internal
No. 16F28 Bryant Internal
No. 16-38 Bryant Internal
No. 24-36 Bryant Internal
No. 24-36 Bryant Internal
No. 24L36 Bryant Internal
No. A3-16" Arter Rot. Surface
No. B24, 25" Chuck Arter Surface
No. 8 Hanchett Double End Disc
No. 214 Besly Double End Disc

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16 ML 16 LeBlond Semi-Automatic
14"x36" cc Amer. Grd. Hd., M.D.
27"x84" cc Amer. Grd. Hd., M.D.
36"x126" cc Putnam Grd. Hd., M.D.
No. 2 W. & S. Geared Head
No. 5W Acme Universal
No. 7A Jones & Lamson (1942)
No. 1A Warner & Swasey
No. 3AL Gisholt Cross Slide Tur.
No. 3H-10 Libby International
No. 4A Warner & Swasey M.D.
No. 4A Warner & Swasey (1944)
No. 4FU Fastermatics, Tur. Type

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No. 4 Cincinnati Dial Type Pl. (1942)
118 Van Norman Hyd. Mfg. (1942)
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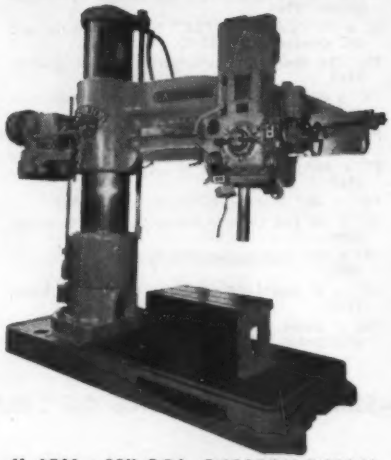

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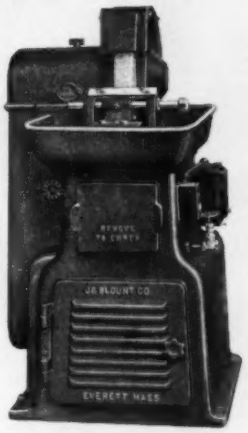

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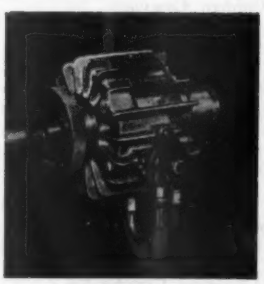

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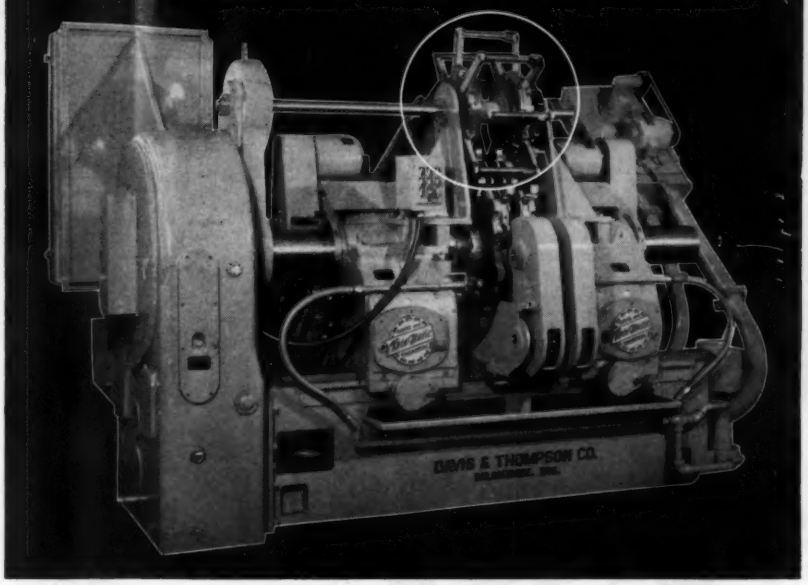

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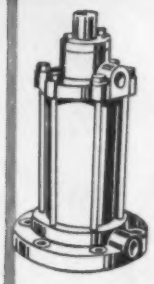

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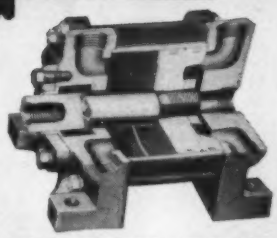

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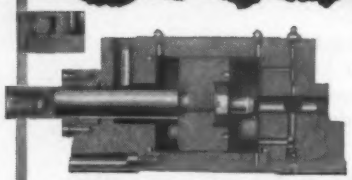

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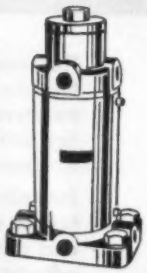

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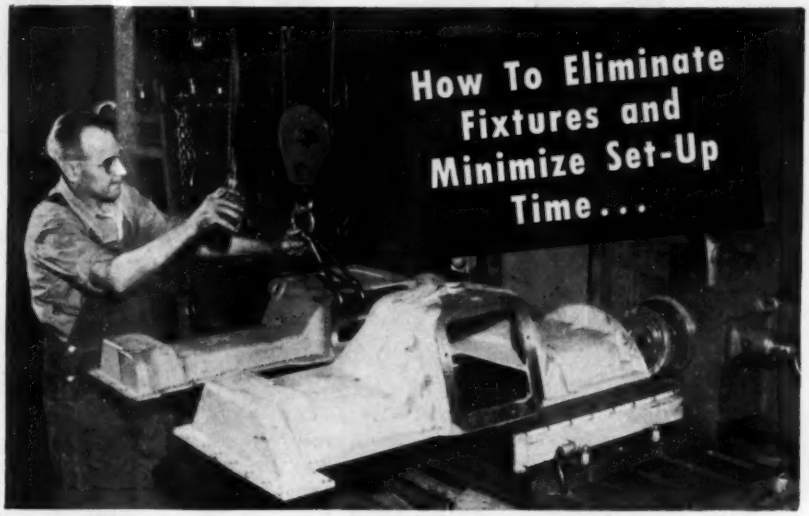

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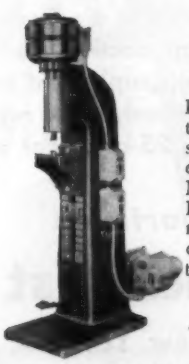

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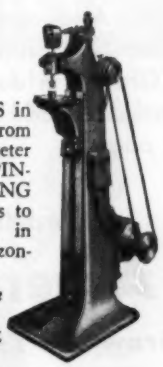

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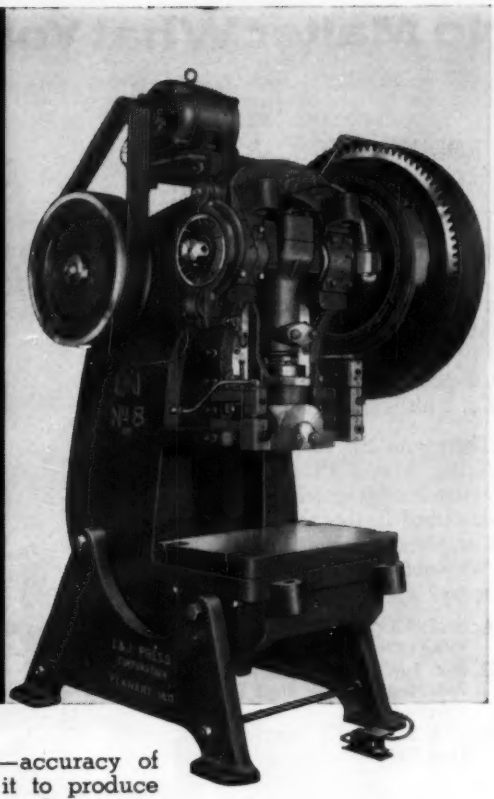

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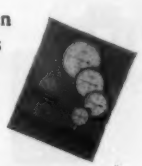

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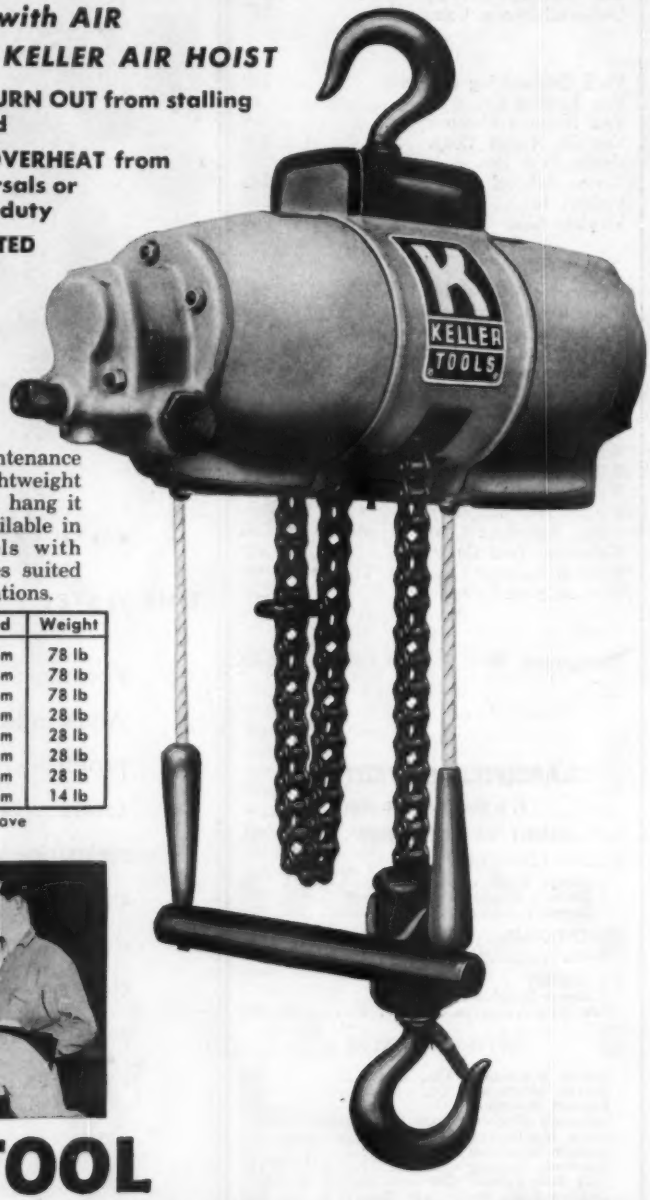

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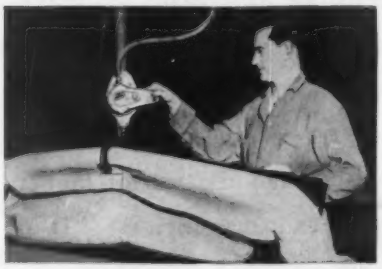

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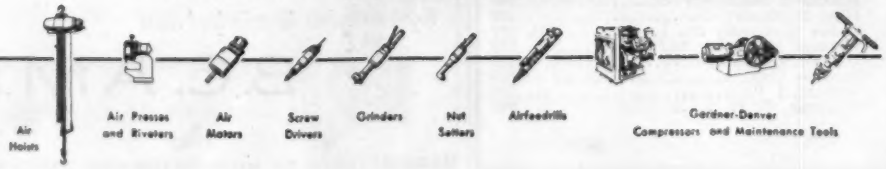

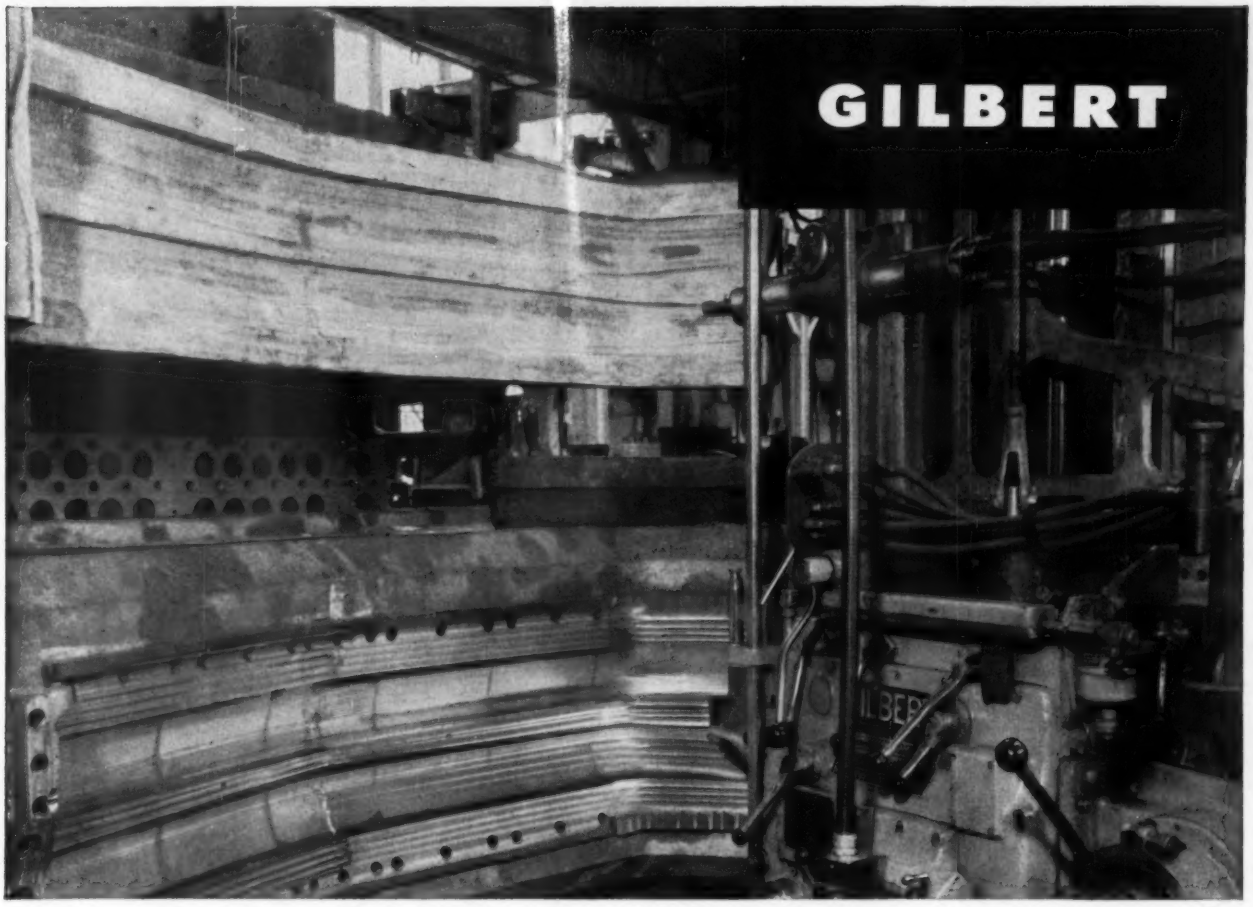

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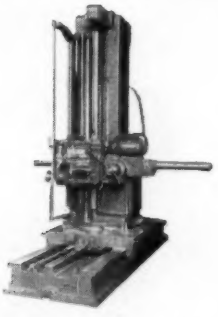

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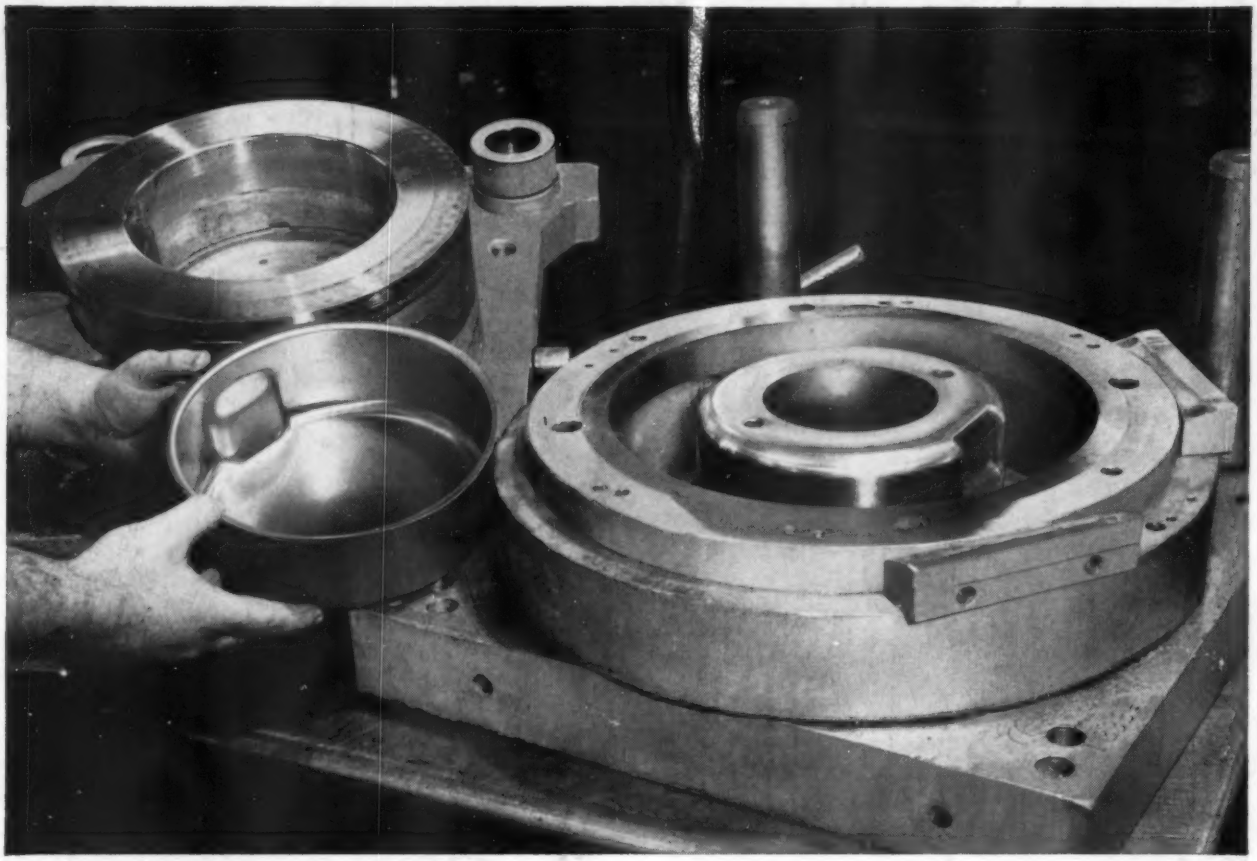

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